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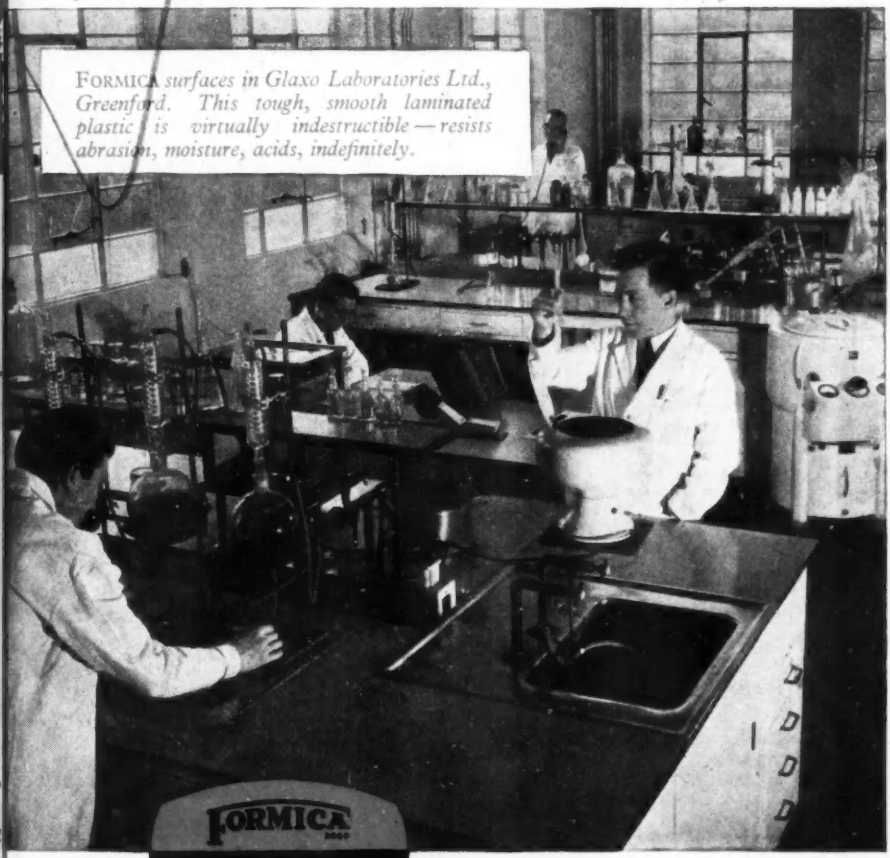

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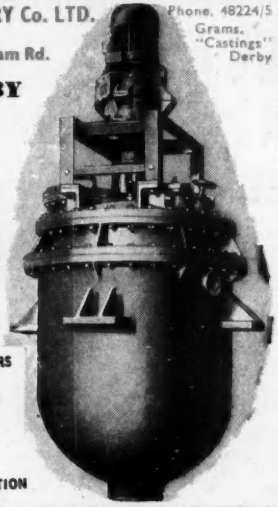

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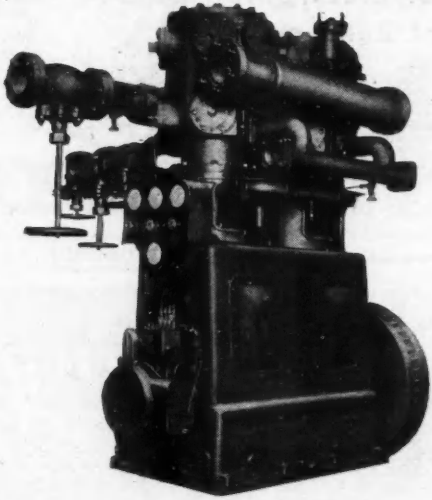

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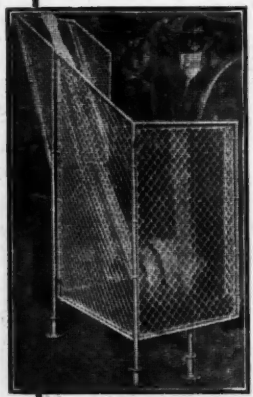

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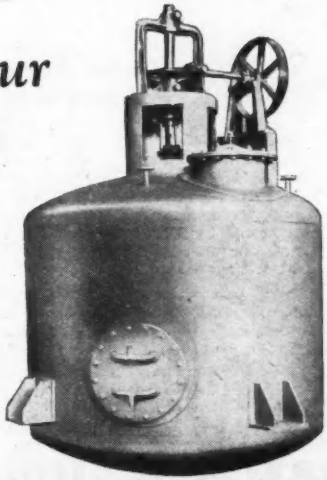

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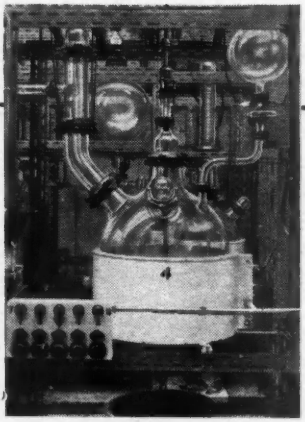

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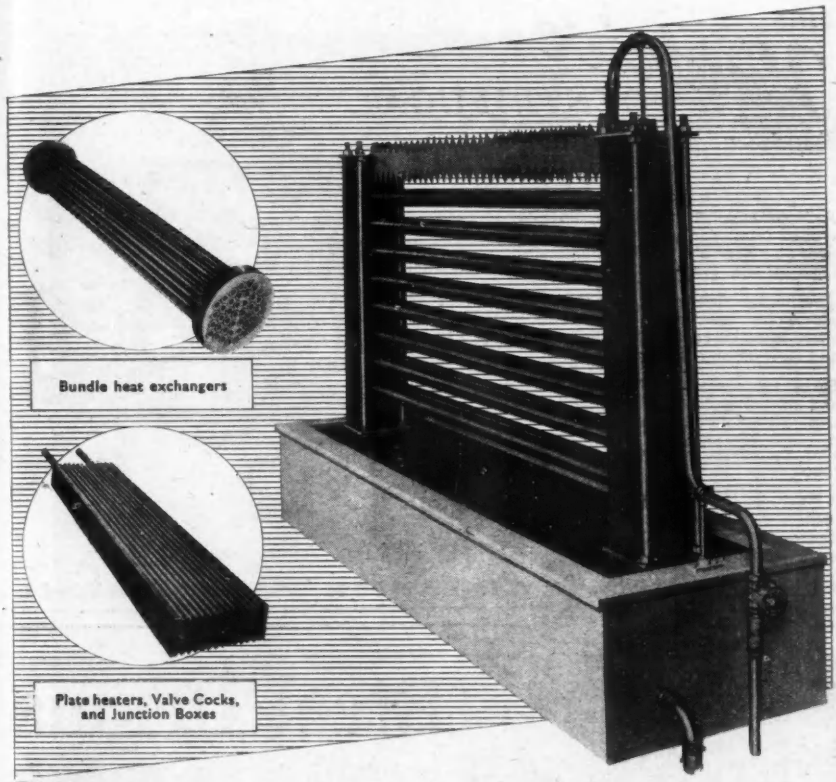

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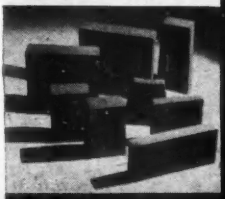

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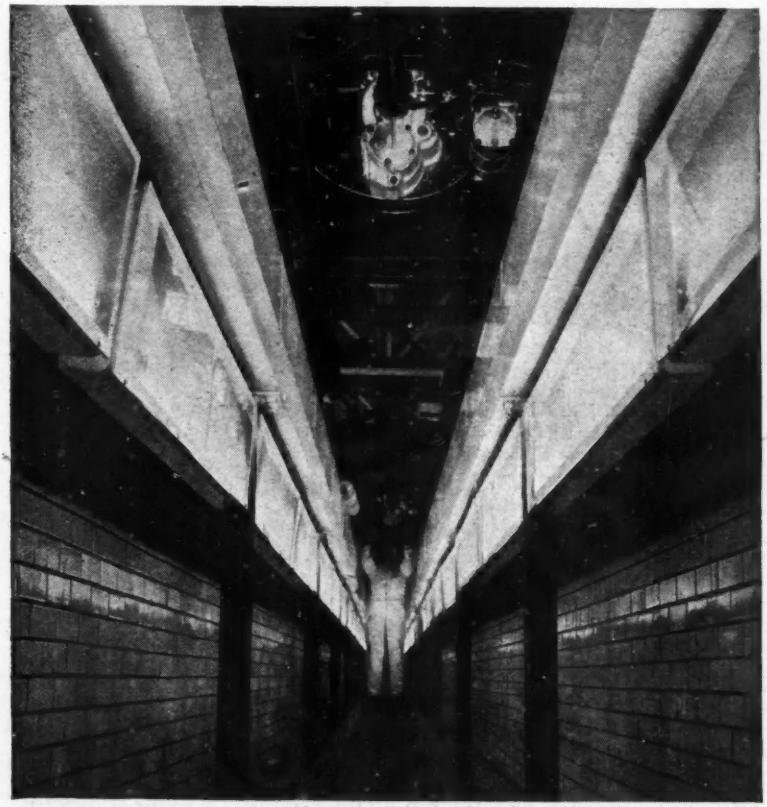

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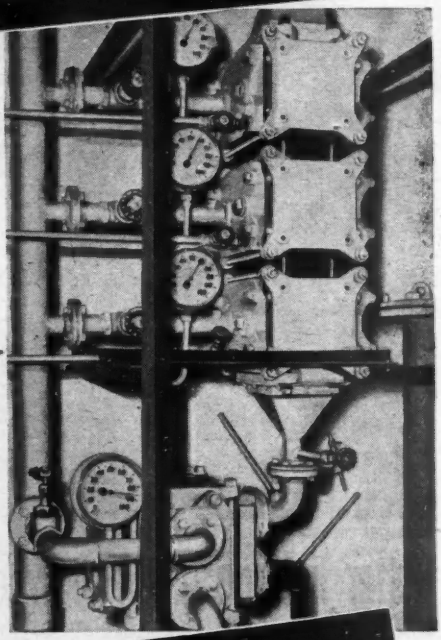

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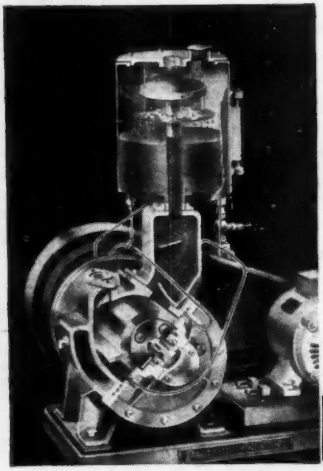

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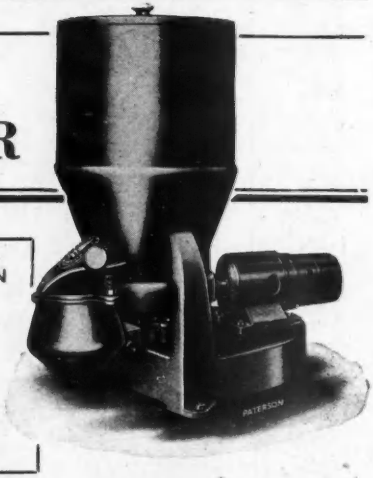

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Volume LXVII 20 December 1952 Number 1745

Thoughts at Christmas

SHOULD there be any other topic than Christmas for the last leader before the 25th? This we dared to ask last year and now to our sharply realised regret we remember that not even one soberly scientific reader answered it with an indignant 'yes.' Even more recklessly we exhausted in 1951 a list of plausible connections between chemists, chemistry, and Christmas sufficient for any prudent writer to cover 1952 and 1953 as well. Now with the paper in front of us as white as Christmas in fiction we are gradually realising we have nothing new to say. We can, of course, indulge in repetition, a gambit not seasonally unknown in Fleet Street whose Christmas numbers would risk disaster were they to display too much novelty, for it is a festival of scarcely changing rites. The reaction between human nature and December 25/26 is consistently replicable although its many components and phases would defy the Phase Rule. It is, indeed, this annual sameness of Christmas that has become its most striking modern characteristic. For now we live for the rest of time in a changing and unpredictable world and the changeless event is an eighth wonder. Not even the relentless and ever-increasing commercialisation of Christmas has been able to alter the basic formula—the old symbols remain the same, holly, snow, carol-singers, miniature trees in the lounges, and stockings (perhaps nylon but it makes no difference) at the ends of children's beds. None of these simple things has been revolutionised by the sales managers and copywriters who must approach Christmas with an inflationary economic pressure.

The span of childhood that supports the illusion of Santa Claus is shorter now. The desire to believe is thwarted all too quickly with realism and in an age of mechanical triumphs children soon suspect that a somewhat elderly adult is unlikely to enter a room through a panel electric fire. But a brief period of blessed belief still exists. It is perhaps a less comforting thought that children insist even more vigorously upon the honouring of the illusion after they have seen through it. Psychologists who

contend that the tradition is harmful might well concentrate more of their attention to this end of it. Once it is 'only Father' the size of the stocking is grossly enlarged. There are parallels with the Welfare State that we should be tempted to elaborate at any other time of the year.

If the mechanism of Christmas as a festival of giving has never changed, the toys are vastly different. The aunt or uncle who at this time of the year has visited unaccustomed shops will have been surprised to an extent dependent upon reliability of memory. Moulded plastic seems each year now to contort itself into more versatility—and, mercifully, the prices are not as forbidding as in the first few post-war Christmases. But the toys themselves are disturbingly contemporary 'atomic,' 'electronic,' and even 'supersonic' devices compete for the tree and stocking. These must be their labels even though the operative power is still based upon wound elastic, clockwork spring motors, or torch batteries. As a chemical uncle, the writer found some disquiet in the minor position of that once fairly popular gift, the chemistry outfit. There are probably no statistics available but it would seem that many less of these are sold than 20 years ago. If so, it is doubly regrettable at a time when the supply of chemistry teachers inversely reflects the importance of their subject. The first impulse to become a chemist has often sprung from a cardboard box containing a few test-tubes, a spirit burner, filter-papers, and a pot or two of chemicals. Alas, the modern kitchen frowns upon home chemistry—it was much easier in the days of that condemned appendage, the scullery. It might be worth the casual thought of a few chemical enthusiasts to design new kinds of home chemistry outfits that make a more modern appeal and at the same time do not outrage the limitations of modern non-spacious houses. These are not matters that are ignored in the U.S.A. where currently Science Service, a non-profit-making institution for the popularisation of science, offers for about £1 a Christmas gift of mineral specimens, fluorescent chemicals in phials, and a 110-volt argon lamp, complete with instructions for 26 experiments 'on fluorescence and phosphorescence.'

On Other Pages

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Notes & Comments

References Systems

IT is good news that the so-called Harvard System' for making references to literature has been abandoned by the Society of Chemical Industry (see *Chemistry & Industry*, 1952, **49**, 1183). The marriage—or might it be better termed a flirtation?—has been of Hollywood duration. Though reasons for reverting to the time-honoured numerical system have not been given, we can suspect that writers of papers—and particularly of subject surveys in which the total number of literature references may be well over 100—have been making their opinions felt with no uncertain forcibility. The plain truth is that the Harvard System is cumbersome. When a paper is referred to, the name (or names) of the author must be given in the text; then, when the text is finished, all the names thus mentioned must be put into alphabetical order for the bibliographical list. This imposes upon the writer of a substantial paper a burden of about half the weight of preparing the index of a book. It is hardly justified unless the readers derive exceptional advantages that no other and simpler system can offer. Also, the Harvard System is overtied to names as the reference tag. Quite often in the survey type of paper it is necessary to refer to anonymous contributions or to unsigned publications of government or international origin. Though such references can be accommodated by the Harvard System, the result is untidy and cumbersome. Two or more references to that ubiquitous author, '*Anon.*', require the revival of the numerical system to give distinction. If the numerical indices must be revived at all, why not stick to the simple and well-understood system that was entirely numerical? As from 1 January, 1953, that will be the policy of all Society of Chemical Industry publications. It is a welcome decision.

Fertiliser Profits

DIVIDENDS from companies manufacturing fertilisers seem recently to have run round about the nine per cent figure. It seems desirable that the production of materials so critically essential for our economy should be healthy—and a lesser degree of prosperity might well discourage future development. It is often said by farmers, however, that fertilisers have become too costly, and to some extent this has been admitted by the Government in their reintroduction of subsidy schemes for nitrogen and phosphates. It is not uninteresting to compare the profitability of fertiliser manufacture. When this is done it is strikingly clear that the farmer can make a much bigger rate of profit than the shareholder's nine per cent. It is not a difficult task to estimate the average return that a farmer may expect from specific expenditure on fertilisers. Years of field research have established the responses of different crops. The costs of fertilisers and the present-day values of produce are not only known but are virtually fixed. If maximum costs for fertiliser dressings, minimum estimates for extra yields and conservative assessments of crop prices are used in making the calculations, a very fair picture of fertiliser profitability for the farmer emerges.

Christmas Greetings
and
Best Wishes for the
Coming Year
from
The Editor, Manager
and Staff
of
THE CHEMICAL AGE

Attitude Impracticable

WITH wheat the application of appropriate fertilisers will give a return in value of extra grain (forgetting the value of the extra straw) that is at least 43 per cent and at most 274 per cent more than the cost of the fertiliser. The range may seem wide but it expresses the extreme differences of good land needing help from nitrogen only and of very poor land needing help from nitrogen, phosphates, and potash. The less the inherent fertility of soil, the more must be spent upon fertilisers to achieve good crops. Probably few fields in this country could show as high a percentage return as 274 per cent and nor is it likely that a high proportion of wheatland will show as small a return as 43 per cent. These calculations have been based upon field data from more than 150 tests, and upon the minimum yield responses of wheat to full fertiliser treatments. With potatoes, tests conducted in Northern Ireland for three years have shown that an extra phosphate supply, now costing 25s. per acre at the most, gives an extra yield of 12 cwt. worth at the lowest market value £5 9s. 6d. Even when deductions are made for the cost of handling the extra crop, the return is at least 160 per cent of the outlay on the extra fertiliser. 43-274 per cent, 160 per cent, these are high rates of return on any investment. It is true that the farmer must wait some months between buying fertiliser and getting payment for the harvest but for the annual crop the period should not be more than twelve months at the longest. Figures such as these make it difficult to understand why fertiliser usage in this country has fallen since 1950 by as much as a quarter. Perhaps too much of our agricultural research work has been expressed in terms of weights and too little in terms of £. s. d.

King Gustaf Adolf of Sweden presenting the chemistry prize to Dr. A. J. P. Martin. Dr. R. L. M. Synge, with whom he shared the award, is seen behind

Nobel Prize Presentation

IN the presence of an audience of some 2,000 distinguished guests, King Gustaf Adolf of Sweden, on Wednesday, 10 December, presented the Nobel Prize for Chemistry to two British scientists, Dr. Archer John Porter Martin, of London, and Dr. Richard Laurence Millington Synge, of Mùchalls, near Aberdeen (cf. THE CHEMICAL AGE, **67**, 664).

Professor Arne Tiselius, of the Royal Academy of Science, Stockholm, in his address said that the method of filter-paper chromatography evolved by the two British doctors had already found extensive application in all branches of chemistry. Important discoveries had been made with it.

By the work of these scientists a method had been found for the separation of substances from complicated mixtures and the solution given to a problem which had occupied a key position since the very beginnings of chemistry, said the professor.

Partition chromatography had had extremely important applications when used as a means of studying the structure of giant molecules. In this manner, said Professor Tiselius, it had been possible to attack problems of the structure of proteins and carbohydrates with considerably greater prospects of success.

Recent Advances in Fluorescent Materials

Increasing Variety of Applications

By A. E. WILLIAMS, Ph.D., F.C.S.

FLUORESCENT materials are being increasingly applied to the manufacture of inks, dyes and the coating of papers for special purposes. While fluorescence phenomena have been well known for many years, the scientific use of them for signalling or display devices is of comparatively recent date, and has in fact resulted from a systematic study of the physical condition determining maximum brightness.

In the case of the material rhodamine, for example, if one makes a strong solution of 5 or 10 per cent strength, it appears as a rich magenta or red dye; but if the concentrated solution is poured away and the containing vessel washed out with water, the dilute wash water exhibits strong fluorescence. The latter depends, therefore, to a great extent upon dilution; though on over-dilution the brightness diminishes. To obtain a strong fluorescence the dye must be in solution. The dye alone, if added to a medium such as varnish and applied to paper, will give when dry merely a colour.

Same Colour Produced

If the dye be dissolved, however, and then dried out in admixture with a synthetic resin, which is then polymerised and ground into fine particles, these particles on dispersion in another medium will produce the same colour, but greatly intensified by the added brightness of fluorescent light caused by absorption of ultra-violet energy. It follows then that a fluorescent ink or coating is made by dispersing in a suitable varnish or other medium fine particles of a fluorescent dye in the form of what may be regarded as a solid solution.

A feature of most fluorescent dyestuffs is that they are activated far more intensely by ultra-violet light than by visible light. The visible colours occupy only a very small part of the whole spectrum, consisting of rays having wavelengths of about 4,000 to 7,500 Å. As the wavelengths get shorter they extend through the near ultra-violet, the extreme ultra-violet, the X-rays, radio-active rays, and right on into cosmic rays. At the other end of the spectrum, as the wavelengths become longer the infra-red region is entered.

The matter of wavelength is of great importance in connection with fluorescent inks or dyes. While a dye like rhodamine, which is a brilliant red by reflected light when applied to a sheet of paper, will absorb light of its complementary colour green, and the energy so absorbed will be converted into orange light by fluorescence; the intensity of the fluorescence will be immensely greater if the dye be illuminated with ultra-violet light, which it also absorbs.

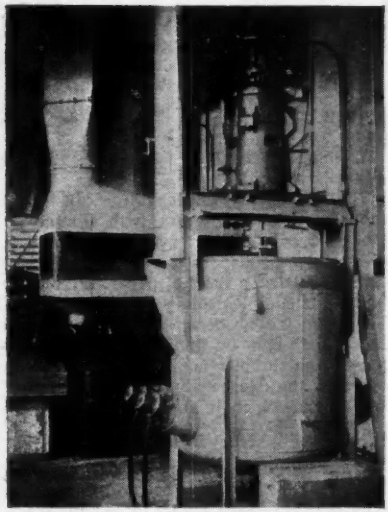
More Brilliant

Investigations show that dyes which are fluorescent in the visible spectrum are much more brilliant in the longer ultra-violet rays, and the visible effect on fluorescent substances is plainly produced by wavelengths in the region of 3,600 to 3,900 Å. It is found that the fluorescent reflected light produced by this band, when measured photo-electrically, is many times greater than that produced by visible daylight. This has been shown to be true by tests carried out on fluorescent pigments now in commercial use, wherein a patch of one of the pigments is very luminescent when radiated with a wide range of ultra-violet from the Wood's glass lamp.

If, however, a filter is placed in front of the lamp, thus cutting off all but the ultra-violet present in daylight, the brilliance will be little affected; but if the patch is then illuminated with visible light from which all ultra-violet light has been eliminated by the use of a filter, the fluorescent light reflected would be comparatively feeble. In practice, this feature makes the fluorescent inks and paper coatings particularly effective at dawn and dusk, when the brilliance remains entirely undiminished.

The really strongly fluorescent dyes belong to a few restricted classes, such as rhodamine in the xanthene group; euchrysin 2G in the acridine group; and safranine in the azine group.

When considering the use of the fluorescent materials, three chief factors have to



[Courtesy of Dane & Co., Ltd.

Fig. 1. Large motor-stirred, thermostatically-controlled vessel for melting the synthetic resins

be taken into consideration: permanence, that is, minium fading; visual brilliance; and non-interference between pigment and suspending medium. In the pigments themselves it has been found that dispersions of the dyes in urea-formaldehyde or melamine-formaldehyde resins—solid solutions as they are termed—15 mg. of dyestuff per c.c. is required in the case of red dyes, and up to 25 mg. per c.c. for dyes of less refrangibility. The cured resins containing the dye are ground to a particle size of a few microns, generally between 20 and 50; and these in turn are dispersed in a water-white ultra-violet-transparent varnish, the refractive index of which is as nearly as possible equal to that of the resin-pigment.

In Figs 1 and 2 are seen plants used in the manufacture of typical fluorescent materials, showing respectively, a large motor-stirred thermostatically-controlled vessel for melting the synthetic resins and blending the dyestuffs; and the infra-red curing apparatus wherein the coloured resin particles are carried on an endless band beneath a series of infra-red elements.

When correctly applied, fluorescent materials now on the market will re-emit as much as 120 per cent of the visible light falling upon them, whereas the brightest organic pigments will reflect only about 60 per cent. The extra brilliance is, of course, due to the sum of the light produced by fluorescence and that reflected from the visible spectrum in the ordinary way. There is some fluorescence caused in the case of rhodamine dyes from the green wavelengths absorbed, but there is sometimes confusion of thought as to the relative importance of the absorption of rhodamine in the visible and the near ultra-violet.

During the preparation of the materials, the Switzer brothers of the U.S.A. discovered that if the dye was first enclosed in, or 'clothed' with the resin—the *p*H of which has to be carefully controlled—and after grinding the particles were re-dispersed in another medium, fading was very much diminished. With British-made fluorescent products, in the light of an office or well-illuminated building the full fluorescence has been maintained for three years or more; while in outdoor light the original fading time has been extended from a few days to about two months.

To obtain the greatest brightness the particles are distributed so that the final printed film is three mils thick when applied to poster printing or paper coating. In this thickness or depth of film something between 0.000015 and 0.00003 gram of pigment is distributed per square centimetre of surface area. The physical conditions so provided enable light to penetrate right through the layer to the white background, and by internal reflection on to the pigment particles. With the scattering effect, the whole 3 mils layer becomes 'alive' and produces the extraordinary brilliance to which one is now getting accustomed in modern poster advertisements.

Silk-Screen Process

Because of the desirability of a 3-mil thickness of ink on a poster or other sheet, the obvious way to print is by the silk-screen process, where the thickness or depth of the stencil can be made to give a heavy coating. Another method of application which has been recently produced is by water colours made by milling the pigments with polyvinyl alcohol; these may be applied by brush or spray-gun. Waterproof paints for treating large surfaces have also been produced.

The relatively few dyestuffs which exhibit fluorescence require to be used in a highly pure form; the purity having an important influence on the ultimate brightness. In dealing with a dye such as xylene red, for example, one delivery may be made of a so-called 200 per cent strength, and a later one of 400 per cent strength material. Now although by using twice as much of the 200 per cent product it is possible to obtain the same colour concentration, the fluorescence output may be considerably lower.

It is known that some of the molecules of a system emitting fluorescence contain a much higher electronic energy than that corresponding to the actual temperature of the system, and that excited molecules can lose their excessive energy by collisions with other molecules, by so-called quenching. In the laboratories of British manufacturers of the fluorescent materials, investigations have indicated that a dye diluted with an electrolyte such as sodium chloride may have a quenching effect, especially as the resin solution in which it is dissolved is a conducting medium.

Treatment of fabrics with fluorescent dyes, both by deposition of the dyestuff within the fibres of the woven material, and the solution of the dye in the dope from which the fibres are spun, is being increasingly applied. The idea of utilising fluorescence in spun materials is not new and many years ago one investigator proposed to lay a yarn of fluorescent dyed hemp among the other yarns in ropes whereby the rope could be identified in ultra-violet light; for this purpose he used the sodium salt of the sulphuric acid of methylated primuline base.

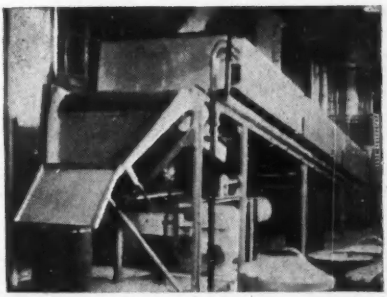
Work in U.S.A.

In recent years a considerable amount of work in this sphere has been carried on in the U.S.A. by the Switzer company which has produced fabrics of great brilliance. For the treatment of the fibres of rayon or cellulose acetate material, the fluorescent dyestuff can either be dissolved in or deposited within the material; this process being analogous to the technique of fluorescent ink manufacture in which the fluorescent material is dissolved in a synthetic resin and afterwards polymerised. A feature of the Switzer processes is that some of them involve dissolving the fluorescent dyestuff in a solvent which has a swelling action upon the fibres or filaments.

As an example, 6 oz. of white cellulose acetate satin is dyed by immersion for two minutes in an aqueous bath of 50 per cent strength alcohol, containing 0.3 per cent of a colourless ultra-violet fluorescent dye. This is given a cold rinse and then over-dyed by immersion in an aqueous bath containing 35 per cent of commercial formic acid and 0.65 per cent Pontacyl Brilliant Blue RR. The fabric after rinsing is subjected to a five minutes immersion in a 10 to 15 per cent ammonia neutralising bath; rinsed again and then tentered and dried in the normal manner. The result is a fabric which has a brilliant daylight fluorescent blue.

In the dyeing of fluorescent fabrics, the same care has to be taken regarding concentration and distribution of the dye in the solid solution formed in the filaments. The maximum amount of dye per cubic centimetre of fabric lies between 0.025 and 0.015 gram; while the amount of dye dispersed must not exceed 0.0005 gram per square centimetre of surface of the fabric.

Fluorescent fabrics of various colours were used by the American Forces in the last war. A signal laid on the ground can be observed by an aeroplane flying at an altitude three to four times greater than is the case with that of a similar but purely subtractive colour. To test the visibility of fluorescent fabrics when carried by aircraft, a U.S. helicopter carrying in a prominent position a piece of fluorescent fabric, ascended to a great height and then descended at normal speed; the fluorescent fabric became visible from the ground 4½ minutes before any other part of the helicopter was seen. Considerable use is being



[*Courtesy of Dane & Co., Ltd.*

Fig. 2. Infra-red curing apparatus

made of fluorescent signs and signals in the present conflict in Korea.

Use of fluorescent fabrics and textiles has caught the American public very forcibly, and doubtless when available in this country one will see a good deal of the materials here; particularly when fluorescent dress materials in pastel shades have been perfected. One of the Switzer processes is concerned with producing a daylight fluorescent fabric comprising the steps of dyeing a cellulose acetate or cellulose ester fabric with an invisible fluorescent dye, and then 'shading' the fabric with a subtractive dye; the quantity of the subtractive dye being less than that required to quench the emission of visible light by the invisible dye in response to incident daylight. This involves combining the visible fluorescence of an invisible organic compound with a subtractive colour which in itself is not necessarily fluorescent.

To give some idea of the possibilities of fluorescent dyed textiles, it may be mentioned that in the U.S.A., apart from dress and theatrical materials, and military signals, umbrellas and handbags are popular, while even fluorescent shoe laces have become the vogue. Attractive fabric designs are now available such as plaids and tartans, in which the fluorescent colours form only a part of the design. Fluorescent flags are also being made in America.

Method of Testing

Specimens of fluorescent inks are tested by making a silk screen sample having the specific coating thickness of 3 mils. A piece of uniform size of the sample is placed in a holder at an angle of 45 degrees to a beam of ultra-violet light from a Mercra lamp, which is a high pressure mercury vapour lamp filtered with an outer bulb of Wood's glass. Interposed is a Chance filter which cuts off all but the band of ultra-violet light. The fluoresced light is deflected on to a barrier layer photo-cell and the current measured with a microammeter. This result may be compared with the fluorescence produced by illuminating the specimen with selected bands of the visible spectrum from a monochromating device.

For the purpose of testing fluorescent inks it is possible to make a simple ultra-violet spectrograph which has an accuracy within a few Å units. This consists of a simple slit—two safety razor blades, for example—and a small fluorite or quartz collimating lens, behind which is a diffraction grating replica mounted on a flat quartz plate. The ultra-violet spectrum from the grating is focused by a second lens on to a back taking a photographic plate holder, and it is quite simple by photography to make a wavelength scale to place in contiguity with the spectrum.

Type of Medium

In the preparation of inks or dyes, the type of medium employed is of great importance. It is quite easy to destroy the fluorescence by using the wrong medium, and the medium with which the fluorescent particles are milled has to have not only the highest possible ultra-violet transmission, but also as nearly as possible the same refractive index as that of the formaldehyde or malamine resins with which it is made. There has to be a co-relation between the refractive indices and the absolute maximum of transparency to ultra-violet light. The medium must also be of a character which does not yellow on exposure to daylight, as otherwise it would immediately start filtering out the ultra-violet rays.

Fluorescent inks are very sensitive to contamination. For example, if one uses a dirty silk on the silk screen, or if it is wrapped while the ink is still wet, then dirt will be picked up. When used for poster work, a fairly heavy paper must be used. The reason for this is that the fluorescent inks are very transparent and if there is another colour behind them on a hoarding, one can see right through. The use of the thicker paper has, in general, had the effect of producing a better quality poster. If the ink is applied properly and not over-reduced when it is put on, it will not be washed out by rain. If when it is applied it is over-reduced, it is very much inclined to powder.

Fluorescent inks are supplied by the manufacturers under a quality control licensing system; the idea being to try and get the silk-screen printers to use the colour correctly and not to try to make it go further by over-reducing it. The use of a protective varnish over the fluorescent inks lessens the tendency to collect dirt on the surface and also enables the latter to be washed down.

Flue Gas Removal of Sulphur Oxides

No Commercially Successful Recovery So Far

WORLD shortage of sulphur has given an added impetus to the problem of devising new processes for the recovery of sulphur or its compounds from flue gases. A survey of the developments leading up to the washing of flue gases at power-stations and the investigations into new methods of sulphur recovering now being carried on, was given by R. Llewellyn Rees, M.A., F.R.I.C., M.I.Chem.E., M.Inst.F. (chief chemist, British Electricity Authority, Chief Engineer's Department), to a meeting of the Institute of Fuel held at the Royal Society of Arts, London, on 17 December.

As early as the 17th century, said Mr. Llewellyn Rees, the 'smoake of London' was the cause of the famous diatribe *Fumifugium* by John Evelyn who was concerned about '. . . . some few particular tunnels and issues, belonging only to brewers, dyers, limeburners, salt and soap-boilers and some other private trades. One of whose spiracles alone, does manifestly infect the air, more than all the chimneys of London put together besides.'

Chimney Recommendations

Gases were evidently discharged at a low level in those days, for the editor of the 1772 edition of *Fumifugium* remarked that 'Many of these buildings have no chimneys and appear to be constructed purposely to beat the smoke downwards.' He recommended: 'Till more effectual methods can take place, it would be a great service, to oblige all those trades who make use of large fires, to carry their chimneys much higher into the air than they are at present; this expedient would frequently help to convey the smoke away above the buildings, and in a great measure disperse it into distant parts without its falling on the houses below. Workmen should be consulted, and encouraged to make experiments, whether a particular construction of the chimneys would not assist in conveying off the smoke, and in sending it higher into the air before it is dispersed.'

If this recommendation had been kept steadily in mind by industrialists and engineers it is probable that flue-gas washing would never have been needed at power stations. The development of the principle of natural draught did indeed improve combustion and lessen the emission of smoke and tar. The tall chimney and the relatively high gas temperature which cause the draught helped to dissipate the products of combustion into the upper air.

Luftwäffe Had Say

After consideration of some of the theoretical aspects of the removal of sulphur dioxide from flue gases, the speaker went on to describe the original and modified processes for Battersea power station. The plant for the first method was closed down during the early part of the last war because the plume of condensed water vapour coming from the chimneys was a mark for enemy aircraft.

At the end of hostilities, when the gas-washing plant was restored, fresh considerations had to be taken into account. As a result of experience gained, scrubbers were designed which were so much more efficient that the whole absorption process could be accommodated in the vertical towers, so that the old main flue was no longer necessary.

Now that almost the whole of the washing is done in one continuous counter-flow absorption, the process is more sensitive than it used to be to loss of water pressure at the sprays, or to blockage of sprays, which virtually opens a bypass through the washer. This is a defect which is still apt to give trouble, especially as spray blockage seems to happen more often than it did before the war. When the sprays are in good order, the performance of the plant is what it was intended to be, in excellent agreement with the theory of absorption around which it was designed.

At the present time this is believed to be the only flue-gas washing process in operation at any power station in the world.

Only Process Operating

The Battersea process can only be used near a large river or the sea, where there is enough water to carry away the effluent. Several attempts have been made to devise a non-effluent process which could be used in any situation. The only one of these which has so far achieved full-scale operation is

the cyclic lime process that was finally developed by James Howden & Co. (Land), Ltd., and I.C.I. (Fertilisers and Synthetic Products), Ltd.

Several experimenters have tried to wash flue gases with a continuously circulating liquor that is kept alkaline by the addition of lime or chalk. These are the cheapest alkalis, so it is unfortunate that calcium sulphate is a relatively insoluble salt. The solids that become suspended in the wash-liquor act as heterogeneous catalysts in the oxidation of sulphite, so that some of the sulphur dioxide that has been dissolved from the gases is converted to sulphate while the wash-liquor is still flowing down the scrubbers.

Blocked With Scale

If the wash-liquor is already supersaturated with calcium sulphate to the limit of its capacity, the addition of more sulphate must cause the immediate precipitation of calcium sulphate from solution. If this precipitation takes place on the scrubber surfaces, as it readily does, the scrubbers rapidly become blocked with scale. Lessing solved this difficulty by applying the principle of the delay tank, which is incorporated in the Howden-I.C.I. system.

First installation of the Howden-I.C.I. process at a power station was at Tir John, Swansea. This station was burning pulverised anthracite duff, and the gas-washing plant was expected to remove the fly-ash from the gases as well as the sulphur dioxide. The double task was heavy for a process that was still in embryo, and the development was so troublesome that the process was eventually taken out of use at this station.

Fulham Power Station

The process was also installed at the Fulham power station, where it proved to be highly efficient; but it was very costly, especially in maintenance. The scrubbers were redesigned later for a rather lower efficiency, and there is no doubt that this alteration would have brought down the cost, although it would still have been great. At this stage in its development the plant was shut down, like the Battersea plant, because the white plumes from the chimneys were believed to be guiding enemy aircraft.

It would probably cost about £1,000,000 to bring this plant back into use at Fulham, and its subsequent operation would be expensive. Justification for such heavy expenditure could not be found. Capital expenditure must be well justified in the straitened circumstances of today, and so the Fulham plant has not been restored to service. Grit arresters have been fitted, and the discharge of flue dust, which became troublesome when the gas washers were shut down, is now properly controlled.

No attempt was made to recover the sulphur dioxide washed out of the gases in the Battersea process, because many of the great difficulties of attempting to do so were evident at the time when the process was designed. In the Howden-I.C.I. process, sulphur dioxide is recovered as calcium sulphate; this is virtually worthless because ample supplies of purer calcium sulphate are available cheaply from other sources. This state of affairs in face of an increasingly serious sulphur shortage has never been accepted as satisfactory.

There is no difficulty in planning processes for the recovery of sulphur or sulphur dioxide which seem to be promising at first sight, but formidable problems appear when an attempt is made to translate these schemes into chemical-engineering actualities at reasonable cost.

Reagent Losses

Loss of reagent owing to the occurrence of side reactions during the gas-washing process is one of the reasons for rejecting schemes for the recovery of sulphur dioxide. Flue gases contain small quantities of hydrogen chloride and oxides of nitrogen which form soluble salts with many metals and radicals whose sulphites and sulphates are relatively insoluble, so that processes which depend upon the removal of insoluble sulphur compounds by filtration may be badly upset by an accumulation of chlorides and nitrates.

The most extensive side reaction is the oxidation of sulphite to sulphate in solution by oxygen dissolved from the flue gases. The liquid film resistance in the absorption of oxygen is considerably higher than it need be in the absorption of sulphur dioxide, so that it is possible to design for preferential absorption of sulphur dioxide. Nevertheless, the proportion of oxygen to sulphur dioxide in flue gases is so high that the influence of relative rates of absorption upon the oxidation rate is not likely to be great.

Oxidation may be activated by many substances in solution or in suspension in the liquid. If the oxidation cannot be inhibited chemically (which is a possibility that never seems to have been fully realised in gas-washing processes) sulphate has to be removed from the liquor in any process where it interferes. The best-known illustration of this is the zinc oxide process which was studied extensively at the University of Illinois.

Modern knowledge concerning the effects of sulphur dioxide upon men and plants has yielded no evidence for the thesis that ordinary flue gas, discharged hot and at reasonably high speed from well-designed chimneys, is harmful to health or to agriculture; on the other hand, washing the flue gas opposes the good effect of a tall chimney by cooling the gas, so that washing may actually increase the local pollution in certain states of weather. It is calculated that existing gas-washing processes cost the community more than the damage done by the sulphur dioxide that they remove. These processes are wasteful in that no useful material is recovered from the flue gas.

Toleration Limits

Processes in which a saleable product is recovered can be expected to become cheaper, or at least no more expensive, as the sulphur content of the gas increases. Unfortunately, owing to the fact that washing the gas causes it to reach ground-level nearer the chimney, it is only processes of the highest efficiency that can be tolerated at power stations especially when the fuel contains a high proportion of sulphur. The problem will have a new aspect if more of such fuels are sent to power stations.

The Fulham-Simon-Carves process, which is being investigated in small pilot plants, may provide a limited answer to it in the rather artificial and perhaps transitory economic circumstances of today, in which scarce elementary sulphur is degraded to the common sulphate radical for use in the manufacture of ammonium sulphate. This process uses gas liquor and some sulphuric acid as raw materials, and produces ammonium sulphate and sulphur. Sites at which even highy efficient processes can be used may prove to be few in number when the fuel is unusually rich in sulphur.

Although many other recovery processes have been suggested, and some of them have reached the stage of pilot-plant investigations, none has shown signs of being successful commercially when applied to flue gases.

Sir John Cass College

Second Term Chemistry Courses

THE programme of courses organised by the Department of Chemistry of the Sir John Cass College, Aldgate, London, for the second term of the 1952-53 session has now been announced.

'Absorption Spectroscopy' will be the subject of 10 lectures by A. R. Philpotts, M.A. (Cantab.) to be held on Friday evenings from 6 to 7 p.m. beginning on 9 January, 1953. The subject will be treated mainly with reference to the practical problems of the chemist and the lectures will be illustrated by lantern slides, photographs, charts and demonstrations. A laboratory course will be arranged in the Summer term.

Beginning on 15 January, 1953, there will be a course of about 10 lecture-demonstrations suitable for analysts and advanced students of chemistry on 'Microchemical Analysis,' given by David W. Wilson, M.Sc. (Belfast), F.R.I.C. The course will be held on Thursday evenings at 6 p.m. and is designed to introduce the principles and technique of inorganic and organic analysis on the micro and semi-micro scales. During the Summer term there will be facilities for laboratory work for a limited number.

G. A. Dummett, M.A., A.M.I.Chem.E., will give a series of eight lectures on the principles and practice of 'Distillation.' This course, intended for industrial chemists and chemical engineers, will be held on Friday evenings beginning on 16 January, 1953.

Courses in the Physics Department include 10 talks for advanced students of physics and for research workers in industrial laboratories by E. G. Steward, B.Sc., A.Inst.P. (Research Laboratories, the General Electric Co., Ltd.) on Thursday evenings at 6 p.m., beginning on 15 January, 1953, and seven lectures by J. Sharpe, B.Sc., A.M.I.E.E., W. R. Loosemore, B.Sc., A.R.C.S., and R. B. Owen, B.Sc., A.M.I.E.E. (Atomic Energy Research Establishment, Harwell) on 'Radiation Detectors and Counters,' to be given on Tuesday evenings beginning on 13 January, 1953.

The Chemistry of Hair

Illustrated Lecture to Cosmetic Chemists

CHEMICAL aspects of hair, its pigment, structure, growth, and methods of waving, bleaching, and dyeing were discussed by Dr. J. L. Stoves in a lecture on 'Hair,' given to the Society of Cosmetic Chemists of Great Britain at its first scientific meeting of the 1952-53 winter sesson held in London, on 12 November. Dr. R. H. Marriott, president of the society was in the chair.

In his talk, which was illustrated by lantern slides, Dr. Stoves pointed out that mammals are distinguished from all other vertebrates by the possession of hair, which chemically belongs to the keratin group of scleroproteins. Among lower animals hair plays important roles, as a regulator of body-temperature and as a protection against either the abrasive action of the environment or the action of light.

Modification of hair has in certain cases given rise to a weapon of defence or attack, for example, the spines of hedgehogs or quills of the porcupine. The grouping of hair-follicles found on the skin of a typical fur-bearer supports the view that in the evolution of mammals hair has replaced the scaly covering of reptilian precursors. Further support for the possible homology of mammalian hair and reptilian scales is given by X-ray analysis of epidermal structures.

Mechanism Discussed

The mechanism of hair-growth, from initiation of follicle development to the shedding of the mature hair, was discussed, reference being made to the autographic record of growing areas in white rats injected with 9-phenyl 5:6-benzo*iso*alloxazine. Nutritional factors influencing hair-growth were considered and their possible significance in cosmetic practice indicated. The relation between habits of toilet and the nature of the whorls and reversals of hair-tracts found in the wallaby and lemur were outlined.

Consideration was given to the chemistry of the pigment of hair, melanin, and the possible rôle of metallic catalysts in the formation of the pigment by oxidation of tyrosine was outlined. Melanin is associated with the normal functioning of the senses of sight, smell, and hearing.

Turning to the structure of hair, the speaker said that at the molecular level keratin was shown to consist of polypeptide chains cross-linked by electrovalent salt linkages, covalent cystine disulphide bonds and by hydrogen bridging. In unstretched hair the polypeptide chains are folded, the precise nature of the fold being as yet unknown. Histological studies of hair were described, their significance as aids to identification and in investigations of the chemistry of cuticle, cortex, and medulla were indicated.

Discussing the chemistry of hair, Dr. Stoves described the actions of alkalis on hair and the use made of these reactions in high-temperature waving using alkaline assistants. Reference was made to the importance of reducing agents in cold waving practice.

Oxidising agents, used in the bleaching of hair and in the development of oxidation dyes, were next considered. Reaction with disulphide linkages yields disulphoxides or cysteic acid groups, depending on the degree of oxidation. Traces of copper in hair were stated to increase the damaging action of hydrogen peroxide; under normal conditions however, oxidation dyes cause little, if any, damage to hair.

Finally the various methods of dyeing the hair were outlined. The colour developed by copper-pyrogallol rasticks depends on the formation of bodies allied to hexahydroxytribenzoquinone and purpurogallin, while 5-hydroxy 1:4 napthaquinone and 2-hydroxy 1:4 napthaquinone are the ingredients of walnut and henna dyes respectively. Oxidation dyes are based on *p*-phenylene diamine, *o*-amino-phenol and like bodies which under suitable conditions can be oxidised to indamines, indophenols, phenazines, or phenoxazines.

Rebuilding Completed

The completion of the rebuilding of its premises at 17 Sun Street has been announced by A. Gallenkamp & Co., Ltd. As from 15 December, 1952, the address is 17-29 Sun Street, London, E.C.2.

MIDLANDS SOCIETY FOR ANALYTICAL CHEMISTRY

Symposium on Organic Reagents

THE November meeting of the Midlands Society for Analytical Chemistry was held in the Chemistry Department, the University, Edgbaston, Birmingham, and took the form of a short symposium on 'Organic Reagents.' Three members of the Analytical Research School at the University presented short papers dealing with various aspects of this subject.

Mr. W. I. Stephen delivered the first paper, which he entitled 'Recent Developments in the Field of Organic Reagents.' His talk was as follows:—

The number of new organic reagents proposed since our last meeting on this subject is limited, but sufficient work has been published recently to warrant some attention. The work at present under investigation on the benzidine series has been continued and some interesting reagents have been developed. Unfortunately, this work has not been entirely completed and it is felt that to include it in this paper would be remiss, especially before it has been submitted for publication in the chemical literature. As a result, only those reagents already mentioned in the literature will be discussed. These can be conveniently classified into four main headings, viz. (*a*) precipitants, (*b*) colorimetric reagents, (*c*) spot-test reagents, (*d*) indicators.

Most Interesting Precipitants

Of the new precipitants, the most interesting is 2-(*o*-hydroxyphenyl)-benzoxazole recommended by Walter and Freiser (1952). This substance forms a chelate structure with several metals, but has been used to give a stable weighing form for cadmium. This metal can be determined in amounts of 1-80 mg. with an average accuracy of 0.3 mg. Precipitation is effected in a tartrate buffer (*p*H 10.5) when almost all interferences are eliminated. Copper precipitates with the reagent, but may be separated at a lower *p*H (3.5-4.0); nickel and cobalt also interfere if present in excess of 20 mg. Prior precipitation with dimethylglyoxime and α-nitroso-β-naphthol respectively removes these metals. The new reagent appears to be more sensitive and selective to cadmium than conventional reagents such as oxine, quinaldic and anthranilic acids. The cadmium complex, after drying at 130°C. contains 21.09 per cent cadmium. A great advantage is the extreme ease of preparation of the reagent from readily accessible materials.

Freiser has also examined the corresponding benzothiazole and benzimidazole. The former substance appears to have similar properties to the oxazole but with greater selectivity as only cadmium precipitates in alkaline tartrate solution. The imidazole is limited in its precipitating properties. Only mercuric ions are precipitated in acetic acid-acetate solution. Copper, cobalt, bismuth and aluminium interfere by consuming reagent to form soluble chelates; the use of excess reagent overcomes this difficulty.

Suitable Thorium Precipitants

Venkataramaniah, Rhagava Rao, and Lakshmana Rao (1952) have continued their investigations on suitable thorium precipitants. Earlier, they recommended *m*-nitrobenzoic acid and *o*-chloro-benzoic acid for this purpose, but now claim *o*-cresoxy acetic acid to be a superior reagent. Precipitation is effected by adding a boiling solution of the reagent to the boiling, slightly acid, solution of thorium and allowing to stand for one hour before filtering. The presence of ammonium nitrate gives a less flocculent precipitant which is readily filtered on Whatman 41 paper. The precipitate is a basic salt of variable composition and must be ignited to give thorium dioxide. 2-132 mg. of thorium have been analysed with an average accuracy of ± 0.2 mg. When appreciable quantities of rare earth metals are present a double precipitation is necessary as the rare earths are co-precipitated with thorium. This procedure is necessary in the analysis of monazite sand. In the separation of thorium from uranium, good results are obtained by slight modification of the general procedure, even when uranium is in 100-fold excess.

Quite recently, Karsten, Kies and Walraven (1952) have examined the cadmium reagent of Ravelka and Kolmer (1930), namely, 3-nitro-4-hydroxybenzene arsonic acid as a possible reagent for determining trace amounts of tin in the presence of large,

(1,000 times) the amount of antimony. They have developed a turbidimetric procedure whereby 0.1-0.2 mg. tin (IV) have been satisfactorily determined. The only interfering elements found were Ti (IV), and Zr, although the presence of elements which impart colour to the solution (e.g., copper, nickel, chromium, iron), necessitated an appropriate compensation of the measured turbidity.

New Colorimetric Reagents

Several new colorimetric reagents have been recently described in the literature. 2: 9-Dimethyl-phenanthroline has been advanced by Smith and McCurdy (1952) as a new copper specific reagent. This substance contains the copper specific group present in other copper specifics such as 2:2′-diquinolyl ('cuproine') or 6:6′-dimethyl-dipyridyl, described by Hoste (1950). Smith and McCurdy have examined a number of 1: 10-phenanthrolines and find, contrary to Hoste's work, that the cuprous complexes formed by these substances are extractable from aqueous solutions using water-immiscible solvents. Smith has named the dimethyl-phenanthroline 'neo cuproine.' The cuprous neo-cuproine complex is bright orange in buffered acetic acid and is formed over the *p*H range 3-10. The complex is completely extracted with *n*-amyl alcohol, isoamyl or *n*-hexyl alcohol and the extract solution can be conveniently examined spectrophotometrically. Qualitatively, neo-cuproine will detect 0.03 mg. of copper at a concentration limit of 1: 1,660,000.

Smith and McCurdy have found that the maximum absorption occurs at 454 mμ, the molecular extinction coefficient being 7,950. The complex obeys Beer's Law over the range 1-10 p.p.m. copper. Iron in amounts of 1 g. does not interfere with the microgram analysis of copper, provided sufficient tartrate is used as masking agent. No other interferences are observed.

A new iron specific of the 1: 10 phenanthroline type has been used by Smith, McCurdy and Diehl (1952) for the colorimetric determination of traces of iron. The reagent has been used to determine amounts of iron of 1-10 μg in 100 ml. water. The absorption maximum occurs at 533 mμ, compared with 510 mμ for 1: 10 phenanthroline (a bathochromatic shift—hence the name). The molecular extinction coefficient is 22,400, more than twice that shown by 1: 10 phenanthroline. Moreover, the ferrous tri-bathophenanthroline complex is extractable with the usual water-immiscible solvents. The reagent has been applied successfully to the determination of iron in municipal water supplies, since the most important application of the reagent lies in the determination of extremely low concentrations of iron. The above workers recommend the range 0.001-0.01 p.p.m. iron to be the most effective and employ a Nessler tube technique to determine iron at this level. The limit of sensitivity of the reagent towards iron is governed by the colour intensity of a blank determination, that is, the extent to which the reagents may be freed from iron. Although Cu+ forms a coloured bis-complex in neutral or alkaline solution, this is converted at *p*H 4.0 into a colourless mono-complex and does not interfere. Incidentally, cuprous bis-bathophenanthroline complex has a molecular extinction of 12,140 and represents the most sensitive ferroin complex yet described for the spectrophotometric determination of copper.

The work of Kumins (1947) and Oesper and Klingenberg (1949) on mandelic and substituted mandelic acids as zirconium precipitants has been extended by Oesper, Dunleavy and Klingenberg (1952). They have prepared a series of *m*-azo mandelic acids by coupling mandelic acid with diazotised solutions of certain aromatic amines, in the hope that a coloured zirconium reagent would be obtained. Of five azo derivatives examined, only one—*m*-azo β-naphthol mandelic acid—showed satisfactory zirconium-precipitating properties, this reagent giving a red precipitate with zirconium. By means of a confined spot test procedure, small amounts of zirconium of 10-100 μg have readily been determined.

Determination of Antimony

A new colorimetric determination of antimony has been developed by Figgis and Gibson (1952). They have examined a series of quaternary arsonium iodides which form insoluble tetra-iodoantimonates (III)—$R.Sb.I_4$. The arsonium iodides under investigation are mixed methyl aryl compounds and the highest sensitivity towards antimony is obtained with triphenylmethyl- or tri-*p*-tolylmethylarsonium iodide, either reagent readily detecting 1 μg. of antimony/ml. The reagent advised is the triphenyl one as it is more readily obtainable. 10-100 μg.

of antimony can be determined with an accuracy of ± 2.0 per cent by precipitating the complex from 2N-acid, extracting the yellow precipitate with *o*-dichlorobenzene and measuring the absorption of the solution with the 'Spekker.' (Violet filter 601). Arsenic, tin, bismuth, lead, copper and mercury interfere but the authors describe suggested methods of partial separation.

Little work has been done recently on new redox indicators. The most interesting of recent publications is that of Lederer and Ward (1952) describing the oxidation of the three N-tolyl-anthranilic acids. Only the *ortho*-acid is suitable as a redox indicator; the oxidation potential is slightly higher than N-phenyl-anthranilic acid.

Mr. M. Kapel next delivered his talk on 'Precipitation from Homogeneous Solution with Organic Reagents.' Precipitation is one of the most important processes in analytical chemistry, and it is not surprising that this operation has been the subject of a great deal of research. The usual method of forming a precipitate is to add the reagent solution to one containing the ion to be determined. This, however, causes the local formation of large excesses of the reagent, which may not only result in coprecipitation of other ions, but also in the rapid formation of crystal nuclei; the final reagent may consist of very fine particles and may even be gelatinous. These defects can be partly overcome by refinements of technique: the distribution of reagent in the reaction vessel may be improved by efficient stirring, and the relative supersaturation resulting from a local excess may be reduced by adjustment of the temperature and the acidity. The most satisfactory procedure involves not the actual addition of precipitant, but its slow and homogeneous formation in the solution containing the required ion.

Hydroxides' Usefulness

Hydroxides have figured largely in the development of this procedure because of their gelatinous nature, and many inorganic reagents have been recommended for their precipitation. Hexamethylene tetramine has been used to precipitate rare earth hydroxides; it slowly hydrolyses to ammonia and formaldehyde and has been recommended for the determination of thorium.

Ammonia may readily be produced in solution by the hydrolysis of amides. Acetamide has been recommended by Willard for the determination of titanium, although, in this respect, urea is undoubtedly a more useful reagent. The hydrolysis of urea proceeds rapidly in boiling water, but scarcely at all at room temperature. Thus, its hydrolysis can easily be controlled to give suitable *p*H values. Furthermore, the rate of increase of *p*H can be controlled by variation of the quantity of urea added and by the use of buffers. Urea is thus suitable for the precipitation not only of hydroxides but also of basic salts. The latter have the advantages of being denser than the hydroxides and of being precipitated at lower *p*H values, so that better separations can be effected. In order that basic salts may be formed with desirable physical properties, suitable anions must, of course, be present. Organic anions are particularly advantageous, since they exert a buffering action on the solution and their basic salts can readily be ignited to the corresponding metallic oxides. The easy control of the *p*H value afforded by the use of urea has brought about the development of the double precipitation procedure which is best illustrated by the following example.

*p*H Value Adjustment

By suitable adjustment of the *p*H value, 99 per cent of the ferric iron present in a solution can be precipitated as the basic formate without the coprecipitation of other metals. If the precipitation is to be complete, however, the *p*H value must be raised, and coprecipitation will occur. By using urea, the *p*H value can slowly be raised until 99 per cent of the iron has been precipitated. After filtration, the remainder of the iron can be precipitated with urea or by means of a heterogeneous process, since the bulk of the precipitate is too small to adsorb any appreciable amount of impurity. Thus, it can be seen that urea offers many advantages as a reagent and it has, accordingly, been used for the determination of iron, aluminium, thorium and gallium.

The use of urea is not confined to the precipitation of hydroxides and basic salts. Barium may be determined by the action of urea on a solution containing a barium salt and potassium dichromate. As the solution becomes alkaline, the dichromate is converted to chromate which, as it is formed, precipitates the barium.

Similarly, it is well known that calcium oxalate is very sparingly soluble in water, but readily souble in dilute acid. Thus, when

an acidic solution containing a calcium salt and an oxalate is boiled with urea, calcium oxalate is slowly precipitated. This method has been used for the determination of calcium in water. It gives an excellent separation of calcium from magnesium, although the separation from the alkali metals is better accomplished by a heterogeneous precipitation.

Precipitation of Oxalates

The precipitation of oxalates from homogeneous solution can be carried out by the hydrolysis of esters of oxalic acid. Thus, ethyl oxalate has been used for the determination of calcium, magnesium and zinc, and methyl oxalate for the determination of calcium, the separation of thorium and rare earth metals from phosphates, and the fractionation of mixtures of lanthanum and cerium and of lanthanum and praseodymium. Since most esters are not miscible with water, the precipitations are normally carried out in aqueous alcohol.

Phosphate and sulphate ions may also be produced homogeneously by the hydrolysis of esters. Both methyl and ethyl phosphates have been used in the presence of sulphuric acid for the fractionation of mixtures of zirconium, and hafnium; the ethyl ester has been used for the determination of zirconium. Dimethyl sulphate has been used for the determination of calcium or strontium, and barium in the presence of calcium. In these precipitations the methanol used to keep the solution homogeneous serves also to depress the solubilities of calcium and strontium sulphates. Diethyl sulphate and potassium methyl sulphate have also been used for the precipitation of barium. Two inorganic procedures deserve notice. One is the determination of zirconium by the hydration of the soluble metaphosphate, the other, that of barium by the hydrolysis of sulphuric acid.

Carbonate ions have been homogeneously produced by a novel and ingenious method, consisting of the hydrolysis of trichloracetic acid in hot solution to chloroform and 'carbonic acid.' In a recent paper, Quill and Salutsky (1952) recommend trichloracetic acid as a reagent for the rapid fractionation of mixtures of lanthanum and praseodymium.

All the methods mentioned so far depend on hydrolytic reactions for the production of ions in homogeneous solution. Several methods depending on oxidation reactions are described in the literature, but as yet, no organic reagents have been applied in this way.

The precipitation of thorium provides an example of precipitation from homogeneous solution without either hydrolysis or oxidation. If tetrachlorophthalic acid is added to a thorium solution, no visible reaction is apparent until the mixture is heated to 70°C., when thorium tetrachlorophthalate precipitates. This reaction can be used for the separation of thorium from the rare earths, although its mechanism is not known with certainty. A similar method involving succinic acid was recommended by Lehner as early as 1908 for the fractionation of the yttrium earths.

In conclusion, precipitation from homogeneous solution represents a notable advance in analytical processes and provides a technique which may exert considerable influence on future researches.

The final paper of the symposium was given by Mr. A. Sykes, who spoke on 'Fluoro-organic Compounds as Reagents in Analysis.'

Few organic compounds which contain fluorine have been used in analytical chemistry, and little detail is given in the literature of those compounds which have been used as organic reagents. One substance worth mentioning is thenoyl trifluoracetone, prepared by Reid and Calvin and used by Huffman and Beaufait in 1949 for the fractional separation of zirconium and hafnium. The zirconium and hafnium chelates of thenoyl trifluoracetate have different partition coefficients between benzene and water. Thus, a separation can be effected which, after three fractionations, is virtually complete.

Defence Secret

This substance has been used to help develop the chemistry of neptunium, but because of its connections with the various United States Atomic Energy Projects, little information is available on this application.

The number of organic reagents proposed in the literature is legion and many of these substances are in everyday use. Although numerous organic compounds containing fluorine have been prepared in recent years, only the above mentioned compound has been examined for possible analytical properties; it thus appears profitable to examine first the fluorine analogues of the conven-

tional organic reagents and it is the purpose of this short paper to discuss the possibilities which arise from such a programme of research.

8-Hydroxy-quinoline and its derivatives have achieved widespread use as precipitants in analytical chemistry and attempts are at present being made to synthesise the trifluoromethyl-substituted oxines. So far little success has been achieved in this project because the synthetic routes which lead to 8-hydroxy-quinolines in general, are not always applicable to the fluorinated intermediates. Thus, in one synthesis, six stages have been successfully completed, but the 7th and final one has proved impossible to carry out. A fifth synthesis is at present being investigated and holds every promise of being successful.

If these fluorine derivatives can be prepared, they may help to answer some intriguing problems concerning oxine and its mode of action in analytical chemistry. The trifluoromethyl group (CF_3-) is normally an electron-attracting group so that it will tend to make the oxine molecule more acidic. According to most theories, this may decrease the stability of the metal complexes formed by such compounds. This may not be a disadvantage since it may make the compound more selective in its reactions.

The fluorine atom is extremely electronegative in character, a fact which may give rise to two different effects. The first is that the trifluoromethyl groups may mutually repel each other and so make it more difficult for the oxine molecules to group closely round the central cation; in other words the compound may only react with large cations such as thallium or indium but not with smaller ones like iron or gallium. The second is that water molecules may become more firmly bound to the precipitate by hydrogen bonding. This latter effect may or may not be an advantage; it might result in the formation of a metal oxinate containing water of crystallisation which is firmly held at a high enough temperature for the precipitate to be successfully dried without fear of water being lost by slight overheating or prolonged drying.

Ideas Speculative

It must be emphasised that most of these ideas are purely speculative and rely on the effective preparation of such compounds. It may be possible by such investigations to extend and improve the theory of the mode of action of this series of chelate compounds even if the substances themselves are of little practical importance as reagents.

Recently, Oesper and Klingenberg have examined the analytical properties of the substituted mandelic acids and report that the *p*-bromo acid gives an excellent weighing form for zirconium. The three fluoromandelic acids have been prepared in this department and qualitative tests indicate that only the *p*-fluoroacid may prove a success for the determination of zirconium. It has a sensitivity of 20 μg. of zirconium per ml. The precipitation is more satisfactory using the *p*-fluoro-mandelic acid than using the unsubstituted acid, but comparisons are at present being made against *p*-bromo-mandelic acid to decide which is the better reagent. With regard to structure, Oesper and Klingenberg found that of the three nitromandelic acids they prepared, only the *p*-acid would precipitate zirconium. Thus, *p*-substitution has some direct effect on the zirconium-binding properties of these glycollic acid derivatives, presumably through some electronic effect in the benzene ring.

Ethylene Glycol Tariff

THE Canadian Tariff Board, inquiring into the price spread on anti-freeze, recently heard a request for a 20 per cent tariff increase on ethylene glycol. Dow Chemical of Canada, Ltd., of Sarnia, Ont., and Dominion Tar and Chemical Co., Ltd., of Montreal, said their new post-war anti-freeze industries were being imperilled by large imports of low-priced duty-free ethylene glycol and glycol products. Unless the duty was increased on imports from the U.S. and other most-favoured-nation tariff countries, the Canadian industries might be driven out of business.

The Dow vice-president said his company had built a $24,000,000 plant at Sarnia to produce ethylene glycol. He noted that during World War II, when Canada needed large imports, little was available from foreign sources. Canada, he said, might be faced with the same problem again, if her post-war anti-freeze industry was threatened.

Ethylene glycol is allowed into Canada duty-free but the finished product, anti-freeze, bears a 20 per cent duty. There were some reports that there was a big spread between its cost and sales prices.

New Type Drainage Pipe

'Alkathene' Used for Nylon Works

A TWELVE-INCH diameter plastic tube, being used to form part of the drainage system on extensions to the Nylon Works at the Billingham factory of Imperial Chemical Industries, Ltd., is the largest drain made of plastic material ever laid in Great Britain. The material is 'Alkathene'—the I.C.I. brand of polythene.

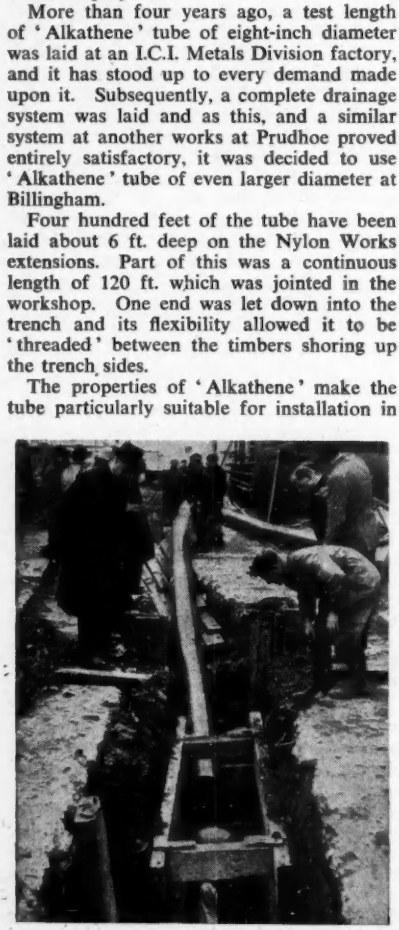
More than four years ago, a test length of 'Alkathene' tube of eight-inch diameter was laid at an I.C.I. Metals Division factory, and it has stood up to every demand made upon it. Subsequently, a complete drainage system was laid and as this, and a similar system at another works at Prudhoe proved entirely satisfactory, it was decided to use 'Alkathene' tube of even larger diameter at Billingham.

Four hundred feet of the tube have been laid about 6 ft. deep on the Nylon Works extensions. Part of this was a continuous length of 120 ft. which was jointed in the workshop. One end was let down into the trench and its flexibility allowed it to be 'threaded' between the timbers shoring up the trench sides.

The properties of 'Alkathene' make the tube particularly suitable for installation in a chemical plant like the Nylon Works. It is light—a 12 ft. length is easily lifted by an average-size man—and also flexible, so that long lengths can easily be joined together before laying by a process using a jet of heated nitrogen or air.

This means that the trench need not be dug until the tube is ready, the laying can be rapidly done—75 ft. were laid in ten minutes at the Nylon Works—and the trench filled in almost at once.

It is unaffected by most concentrated mineral acids, and alkalis have no effect upon it. These qualities give 'Alkathene' tube a big advantage over earthenware pipe, which is heavy, has to be laid in short sections which must be joined up in the trench and for which, if corrosive liquids are to be drained away, a special jointing component must be used.



Laying a 50 ft. length of 12 in.-diameter 'Alkathene' tube

Fatal Arsine Poisoning

DETAILS of a fatal case of arsine poisoning which took place in a works manufacturing arsenic oxide by oxidation of arsenious oxide with nitric acid are contained in a pamphlet 'Accidents—How They Happen and How to Prevent Them,' prepared by the Factory Department of the Ministry of Labour and published by HMSO, price 9d.

According to the report an inferior grade of oxide, giving a copious sludge, was being used owing to difficulty in obtaining supplies of the better grades. When cleaning out one of the digesters it was three-quarters filled with water and emptied after swilling around to remove as much of the sludge as possible. Approximately two inches remained and a worker went inside to finish cleaning. He was using a galvanised iron bucket and soon began to complain of fumes. Later he was taken sick and was allowed to go home. The next day he died and the cause of death was found to be arsine poisoning.

The report points out that gassing always exists when sludge is present. Unless it can all be raked or hosed out from outside the vessel, danger should always be assumed and breathing apparatus worn by anyone going inside. In the case described, there was the particular hazard of arsine poisoning, for the sludge was acid in reaction and contained arsenic. Release of arsine was inevitable when the galvanised bucket came into contact with the sludge.

The West German Plastics Exhibition

New Developments on Show

PRODUCTION of plastics in Western Germany was about 160,000 tons in 1951 and is expected to reach 200,000 tons for 1952, during the first half of which it was 91,000 tons. Exports during 1952 also will probably reach the record figure of DM. 200,000,000 (84,400,000 in 1951). At the exhibition in Dusseldorf from 11-19 October, 1952, there were 245 exhibitors, and visitors totalled about 165,000, including 14,000 from other countries. For about twelve months or more before the show an intensive publicity campaign based on thorough market analysis and research had been undertaken.

A detailed report, with some fine illustrations, of the exhibits is given by Lothar Franzke, in *Chem. Industrie*, **4**, 913-920. A special feature was the Lehrschau or 'Wunder der Kunststoffe' (Miracles in the Plastic World) which presented a general view of wonderful achievement in this field, without reference to any particular firm. It showed the amazing multitudinous uses of plastics in a modern home; also an impressive display in a shop window indicated further numberless uses in travel, sport, clothing, etc. Yet another almost infinite field is in industry—in building, electrical engineering, chemical works, machine construction, and so on. Much interest was shown in the the various scientific uses of plastics, and in the ingenious methods of testing plastics which were to be seen in operation. Other sections of the Lehrschau (Instruction Centre) presented the wonders of macromolecular structure, some of the intricacies of high polymers and other mysteries in the composition of matter. Additional features were fashion shows (Perlon, for instance), Housewives' Afternoon, Lectures to Students, Press Conferences.

New Products

In the actual plastics section chief interest centred on certain new productions, such as the silicones (Bayer and Wacker), silicone oils, fluorine plastics (Hoechst and Bayer), polyester resins in combination with glass fabric or lining; foam or sponge products and sandwich-construction, Moltoprene and other very light weight material such as the BASF Styropor—about one-fourth the weight of cork; exceptionally strong and stable products such as Vulcollan and Hart-Vulcollan; Luvican in transparent form; corrosion-resistant Trovidur (Dynamit AG) which can now be metallised, and the same firm's new Ultralon and Troporit for electrical work; further new uses for Vestyron of Chem. Werke Huls; Harlon, a mixed vinyl and vinylidene chloride polymerisate of the Internat. Galalithges.; several new developments by Chem. Werke Albert; new adhesives by Anorgana and products on a PVC basis or otherwise; Henkel's melamine condensates; varnish resins by Firma Dr. Kurt Herberts. Other products in this section were aminoplasts; Nyhaprene, Nyhagum, and Nyhamin (melamine basis) cellulose triacetate film; new organic peroxides for plastic manufacture (Oxydo-Ges.); new drying preparation Stapa-Hammerschlag by Eckart-Werke.

Chemical Apparatus

In the manufactured plastic or product section there was much of interest in chemical apparatus and apparatus for other industries. These included corrosion-resistant equipment made from Kera, of the Gewerkschaft Keramchem., and other resistant and thermo-stable plant by the same firm; resin plus graphite materials for chemical plant (Sumit-PVC); and other products by different firms. Numerous other exhibits represented the decorative class, for leather and other fabrics, with new uses for Resopal (Römmler), Plexiglas (Röhm & Hass), Coroplast (Fritz Müller K.G.), and PVC products; the new Ornamin press or moulding process (Paul R. Rödiger); Erkaplast cast plastics (Dr. Rudolf Kirberg).

New developments in machine construction were illustrated in another section of the show. Some of these are said to be little known abroad and elicited much interest from oversea visitors. Among those described briefly or merely mentioned was the Kirberg system for resin condensation plant (Carl Canzler) fitted with Schorg system of induction heating, or, alternatively, for resistance heating in laboratory works.

Improving the Status of the Chemist

Work of the British Association of Chemists

A YEAR of satisfactory progress, growing membership, and an increasing desire on the part of many firms employing chemists to consult the association on salary scales and other matters of mutual interest, were reported at the annual general meeting of the British Association of Chemists held at the Waldorf Hotel, London, on Saturday, 13 December. Major R. P. Porter, T.D., B.Sc., the retiring president was in the chair.

Increasing use of the services of the association was being made by members according to the annual report of the council for 1951-1952, and there were indications that the need was growing for expert advice on matters concerning agreements and terms of employment.

Salary Survey

At the beginning of the year a salary survey was carried out among the members, and analysis of the information available indicated that the majority of those concerned were receiving remuneration in accordance with the association's recommended scale of minimum salaries, or better. A summary of the results was published, and a number of employers asked for copies of the summary.

Reference was made in the report to the purchase of No. 14 Harley Street, London, W.1, as the headquarters of the association. It was felt that the association would benefit by having a permanent home and at the same time improve the income from investments held by the unemployed benefit fund. The building would be known as Hinchley House, in honour of the association's first president.

Prosperous Benefit Fund

Membership continued to improve. 152 new members were elected during the year, as against 97 for 1950/51 and 68 for 1949/50. Improvement in the state of the unemployed benefit fund was maintained. There was a surplus of £1,496 on the year's working, and the fund now amounted to £53,354. Unemployment benefit of £573 and refunds of £254 were paid during the year (the corresponding figures for the previous year being £829 and £132 respectively). It was pointed out that again several members over the age of 40, in apparently established positions, had through re-organisation, and so on, of their firms, been quite unexpectedly faced with the necessity of obtaining new posts, and had been glad of the benefit of the fund and the assistance of the association generally.

The council, on the recommendation of the unemployment committee, has approved an increase in the basic rate of benefit per unit to be paid during 1952/3.

In connection with the legal aid given by the association, a member whose appointment had been terminated with one week's notice asked for assistance. The case was taken to court and, although it was the practice of the employer to pay senior staff at weekly intervals, the principle that a qualified chemist is entitled to three months' notice, in the absence of an agreement to the contrary, was upheld. The member was awarded three months' salary and costs.

Legal advice was also given free of charge to 25 other members on matters in connection with service agreements, patents, and so on.

Appointments Service

The appointments service published during the year, in the weekly circular, details of 5,100 posts; of those 71 were inserted at the direct request of the employers concerned.

Salary Scales had been under consideration by the sub-committee throughout the year, and a revised edition was issued, dated February, 1952.

A number of student members had been assisted in such matters as F.E.T. grants, deferment of National Service, and courses of study.

Negotiations had been begun with two organisations in connection with rates of remuneration, at the request of members employed by them. These were proceeding satisfactorily, and in one of the concerns about 30 new members had joined the association as a result. It was becoming clear that the formation of 'groups' of BAC members employed in the same organisation was leading to good relations with managements, rather than the reverse.

Another reminder that members can obtain most classes of insurance cover at a reduced cost through the association was contained in the report. Some members were known to have made savings in that direction which were greater than the amount of their BAC subscription. There are also facilities for obtaining transferable pension policies.

Election of Officers

The following officers were elected for the ensuing year: *President*: Mr. F. Scholefield; *vice-presidents*: Major R. P. Porter, Dr. A. T. Healey, Mr. L. E. Puddefoot, Mr. T. McLachlan; *hon. treasurer*: Mr. H. R. Neech; *hon. secretary*: Dr. F. W. Kay; *hon. registrar*: Mr. H. L. Howard; *trustees*: Mr. C. S. Garland, Dr. H. Levinstein, Miss W. Wright; *hon. editor*: Dr. J. P. Lawrie; *council*: Mr. Norman Sheldon, Mr. R. J. Mollard, Mr. H. Warson, and Mr. J. Wilson, general councillors to fill vacancies due to retirements by rotation.

There was a discussion at the meeting on the work of the association and the benefits afforded its members. Details were given of students who, having sought the help of the association, were able to obtain grants to enable them to continue their education.

A joint discussion is being arranged between the London Sections of the BAC and the Royal Institute of Chemistry on the education of chemists. Representatives of London University, the technical colleges, the Ministry of Education, and industry will take part.

As showing the strength of the unemployment fund, it was mentioned that 10 per cent of the members could be out of work and receiving full benefit each year for 10 years, and the fund would still be solvent. Reserves were of the order of nearly £30 per member.

Student members of the association were given free use of the appointments list during the last six months of their college training.

The Annual Dinner . . . . .

THE improved status of the chemist in industry and the part played by the British Association of Chemists in helping to bring this about, were referred to in the speeches at the annual dinner of the association held in London on Friday evening, 12 December, prior to the annual general meeting.

Tribute was paid by the president, Major R. P. Porter, T.D., B.Sc., to Mr. Colin Alfred Wylie, former president of the association, whose death had occurred suddenly in August at the age of 73. Mr. Wylie was an untiring worker for the welfare of chemists and had been a trustee of the BAC for 19 years.

Proposing the toast of 'The Guests,' Mr. T. McLachlan, D.C.M., A.C.G.F.C., F.R.I.C., said that it was a very pleasing duty which had been allotted to him. It was not possible to mention all their distinguished visitors, but on behalf of the association he extended a hearty welcome to them and their ladies and would like to refer briefly to three of them, all Fellows of the Institute and all chemical engineers.

First there was Mr. H. W. Cremer, C.B.E., president of the Royal Institute of Chemistry, whose accomplishments were well known. His presence was a pleasant reminder of the improved relationship with the RIC. At one time there had been a slight tension between the two organisations, but it was now realised that they were complementary and not rivals, and the BAC was proud if it had helped to make the Institute pay a little more attention to the industrial chemist.

Mr. J. Davidson Pratt, C.B.E., director and secretary of the Association of British Chemical Manufacturers, was so familiar a figure at the association's gatherings that they were inclined to forget he was a guest.

Finally, Dr. F. A. Freeth, F.R.S., former director of research of Imperial Chemical Industries, Ltd., had done much to bring together the universities and industry. No one knew the student mind better than he, and he had skimmed the cream off the top of the universities.

In an entertaining speech, spiced with anecdotes and stories, Mr. J. Davidson Pratt replied for the visitors.

Turning to more serious matters, Mr. Davidson Pratt said that the report of the heavy chemicals productivity team which recently went to the U.S.A. would be published next month. He did not feel that he should really reveal too much about it in advance, but he was sure that it would

contain a great deal of matter to interest members of the BAC. One point mentioned by the team was the far higher proportion of qualified chemists in comparison with operators employed in America than in the U.K.

Dr. F. A. Freeth proposing the toast of the British Association of Chemists referred to the tremendous changes that had occurred during the 50 years he had been a chemist. When he began his career, American chemistry was a joke, there was little demand for the chemist in industry and a student was lucky if he got a job within six months of leaving the university. He had started at £80 a year as a chemist to a tobacconist firm in Liverpool. Later he had the good fortune to become chief chemist to Brunner-Mond, where he had arrived to take up his duties with a hand-cart crammed with apparatus, which was worth £28, bought 'on tick' from the trusting Mr. Towers.

The Burden of a Journal

How different were the circumstances today! There was a widespread demand for chemists and their general status and financial position were better, largely due to the efforts of the BAC. He congratulated the association that it was not broke! This he felt was at any rate partly due to the fact that it had had the good luck, or good sense, not to burden itself with a journal. The increased costs of publications were crippling other associations.

In conclusion, Dr. Freeth said he was very pleased to be at the dinner. The association should do all it could to cultivate the social and communal side of its activities. Man was a lonely creature, and the association could do much to provide the brotherhood so much needed today.

Replying for the BAC, Mr. F. Scholefield, M.Sc., B.Sc., F.R.I.C., head of the department of textile chemistry, College of Technology, Manchester, said they had been fortunate in their speakers. Mr. Davidson Pratt might be said to epitomise the whole chemical industry, while Dr. Freeth was the quintessence of philosophy of science and research.

While the position of the chemist in industry today had undoubtedly improved and salaries were better, nevertheless, with the increased costs of living, the actual value did not always give a satisfactory advance compared with the early days.

Membership of the BAC, although increasing, was not as good as it might be. This was probably due to the demand for chemists. There was a tendency only to turn to such associations when times were more difficult and greater help was needed.

It was customary for the recipient of the Hinchley Medal to give an address at the annual general meeting. As Dr. Levinstein was unable to attend this, he had promised to deliver an address early in the New Year.

Canadian SO_2 Plant

THE new liquid sulphur dioxide plant of Canadian Industries, Ltd., at Copper Cliff, Ontario—first of its kind in Canada—has gone into production. The plant will have an annual output of 90,000 tons, equal to the total production of liquid sulphur dioxide in the rest of the free world, and the equivalent of 45,000 tons of elemental sulphur. Most of it will go to Ontario and Quebec sulphite pulp mills. The project is the result of collaboration by the International Nickel Company of Canada and C.I.L. in developing economic processes for the recovery of sulphur in the form of brimstone, sulphuric acid or liquid sulphur dioxide from by-product gases produced by Inco's operations.

During the 1930's C.I.L. developed and operated, on a pilot-plant scale, a process for the manufacture of liquid sulphur dioxide from dilute smelter gases. Cost of the product, however, was too high to permit it to compete with sulphur. Then Inco developed a new flash-smelting process which resulted in the production of a gas containing 75 per cent or more sulphur dioxide. In 1947, a pilot plant was built to use the gases from this experimental plant, and it was found to be technically feasible to make liquid sulphur dioxide from them. Subsequent developments proved the economic justification of the new process and work on a full-scale plant to manufacture the compound was started in 1951.

Model Shell Truck

Those readers of THE CHEMICAL AGE with small children may possibly have noted the latest addition to the well-known Meccano 'Dinky' toys series. This is an excellent model of the bulk delivery lorry used for the transport of solvents by Shell Chemicals, Ltd.

The Growth of Petrochemicals

Utility & Price Demands Must Be Met

DURING the course of his address 'Petrochemicals—Sufficient Utility at the Right Price,' presented at the semi-annual meeting of the Manufacturing Chemists' Association in New York on 25 November, Mr. Martin Buck said that the recent unprecedented growth of chemicals from petroleum hydrocarbon raw materials was a matter of record. The literature seemed to be flooded with forecasts of demand and methods of forecasting demand. Mr. Martin, who is manager of the Manufacturing Development Department of Shell Chemical Corporation, said that it might be timely to examine the factors which determine the growth of any chemical and to note why these factors were so strongly influencing petrochemical growth.

Everyone was keenly aware, sometimes painfully aware, he said, that the demand for any product was determined by both utility and price. The organic chemical literature taught us how to make hundreds of thousands of compounds, but relatively few had reached substantial volumes in the market place. Most either cost too much or had insufficient utility. It was not enough to produce an interesting molecule of little utility, even for a low price, nor was it sufficient to produce a useful molecule priced too high. Substantial sales volume could only be achieved when both utility and price demands were met.

Sales and Prices

Fundamentally, therefore, chemicals from petroleum hydrocarbons had been produced in large volumes only when they were useful and could be sold at the right prices. As an obvious corollary, as utility increased and/or price could be reduced, sales volume, or growth rate, generally increased.

It was natural for the petrochemical industry to gain its entry into the chemical economy largely by supplying existing raw materials, intermediates, and occasionally consumer products, at lower prices. It must be emphasised that utility of these materials was already established and growth rate could be and was stimulated by lower prices. Lower prices were made possible by a plentiful and reliable source of raw materials, a continually improving technology and the cumulative effect of still larger volume. Raw materials in this classification included the organic chemical building blocks, ethylene, propylene, butylenes and more recently, cyclopentadiene, benzene, toluene, xylenes and acetylene; intermediates include the primary and secondary alcohols from the olefines mentioned, acetone and higher ketones, and more recently glycerine and phenol. The natural or coal tar sources of these materials were augmented and in some cases largely displaced. The list was far from complete, it was growing, and it would continue to grow as long as the utility remained and the price was right.

Importance of Competition

Having established a plentiful supply of low cost raw materials and intermediates, great stimulus was given to the development of new products where the estimated price was right but the utility had to be established. This took a little longer but soon began to account for the rapid growth of recent history. Usually there was competition with existing products but occasionally birth was given to an entirely new field. At this stage, also, competition between processes as well as competition between products became important factors tending to keep costs low.

It was characteristic of the industry and its highly developed technology to establish competitive processes for manufacturing the same commodity. Examples included three methods for manufacturing ethyl alcohol—two from ethylene and one by the Fischer-Tropsch process; two methods for manufacturing *iso*propyl alcohol—one by direct catalytic hydration and one utilising sulphuric acid; two methods for making *n*-butyl alcohol—one by the oxo process from propylene and one by condensation of ethyl alcohol; three methods for manufacturing acrylonitrile—one starting with acetylene, one with ethylene and one with propylene; two methods for manufacturing ethylene oxide—one by direct oxidation and one by chlorohydrination route; three methods for manufacturing vinyl chloride—one from acetylene and two from ethylene; at least three

methods for manufacturing phenol—the latest being the cumene hydroperoxide route which adds to the older processes utilising chlorine or sulphuric acid; two methods for manufacturing phthalic anhydride—one from *ortho*xylene and one from naphthalene; at least two methods for manufacturing acetylene from hydrocarbons—the Wulff process and the Sachsse process, to add to the older route from calcium carbide. Commercial success bred competition not only in process but also in product, and the industry abounded with examples. In the solvent field *iso*propyl alcohol competed with ethyl alcohol and acetates competed with ketones; the polyhydrics, glycerine, pentaerythritol, propylene glycol and diethylene glycol competed with each other; polyvinyl chloride competed with polythene, vinyl chloride copolymers competed with polystyrene; epoxy resins compete with the phenolics; diallyl phthallate resins competed with melamine. These were some of the fruits of research of a dynamic industry. The list could be extended to include many more, but the important point was the energetic use being made of all phases of technology to supply needed petrochemicals at the lowest possible price.

Agricultural Chemicals

Time would permit mentioning only a few of the more important segments of the petrochemical field. Perhaps the most rapidly growing segment was the organic chemicals used in the agricultural field. He was referring to the synthetic organic insecticides, herbicides, defoliants and soil fumigants which had developed only in the last ten years to an estimated sales volume of $125,000,000 in 1951 at the manufacturers' level and before formulation. In this case the rate of development of technology coincided with the supply of raw materials and intermediates for the low cost manufacture of the chemicals. They included DDT, methoxychlor, benzene hexachloride, Chlordane, Aldrin, pentachlorophenol, aromatic oils, DDT, ethylene dibromide and many others. They had been a major factor in maintaining the nation's agricultural production at the needed high level. Increasing the world's production of food and clothing from its limited amount of arable land was so basic that it was hard to conceive greater direct utility for an organic chemical. Technological activity in this field was great, and they could confidently expect continued rapid rate of growth, fundamentally, again, because the utility was there and the price was right. At least two companies now in petrochemicals in the U.S.A. started in the field via the manufacture of nitrogen fertilisers utilising hydrocarbons as the source of hydrogen for ammonia. Few things were more fundamental than nitrogen for the soil to grow more food and clothing. When nitrogen fertiliser could be produced synthetically at the right price, its continued growth was assured.

The most important segment of the petrochemical field dollar-wise was the polymer segment which utilised high molecular weight compounds for the manufacture of rubber products, synthetic fibres, moulded plastics, laminates, adhesives, paints and plastic sheeting and film. The current dollar value of this field before processing had been estimated at $2,000,000,000 per year, excluding the natural and cellulosic polymers.

The most important segments of this field were synthetic rubber, synthetic resins including fibre, and plastics. Synthetic rubber was developed under crisis conditions during World War II, and American technology earned one of its greatest tributes by doing the job so well that both the price and the quality now successfully competed with the natural product. This was undoubtedly the most important example of a steady trend, the use of synthetic organics to augment and then partially replace a time-honoured natural product. The value of the synthetic rubber produced annually today was more than $250,000,000, and continued growth could be expected at a faster rate than the general economy.

Synthetic Fibres

Everyone was aware of the recent rapid growth rate of synthetic resins, including the resin fibres, which had now reached an annual value approaching $1,000,000,000. Improved synthetic resins for the protective coating field were rapidly changing the character of this industry. The basic reason was, once more, better products at the right prices. The plastic field followed the same pattern.

In the field of synthetic detergents they had another example of great stimulus to development from the availability of a plentiful supply of raw materials at low cost. In this case utility superior to the available natural product was the goal.

Site of the Imperial Institute

House of Lords Discusses the Tweedsmuir Report

PROBLEMS concerning the future of the Imperial Institute and the need of more buildings for the Imperial College of Science and Technology were discussed in the House of Lords on Tuesday, 9 December.

Drawing attention to the report of the committee of inquiry into the Imperial Institute, presided over by Lord Tweedsmuir, which has recently been published by the Ministry of Education, Viscount Falmouth asked whether the Government would consider removing the institute to a more suitable site. By this means he contended that the buildings could be freed for use by the Imperial College of Science and Technology.

Failing this, his lordship suggested an independent committee might be appointed to investigate the present uses to which the educational sites in South Kensington were now put or proposed to be put and to make recommendations. It was clear, he continued, that the high hopes originally formed of the work being carried out by the Imperial Institute in 1888 had not been fulfilled. Due to circumstances beyond its control, during some of the most eventful years in British history, the circumstances of the institute had greatly changed.

Insufficient Places

Immediately adjacent was the Imperial College of Science and Technology. There was a great demand for places in the college but they were not available because there was insufficient space for training. Any scheme for erecting a new building would take many years. He suggested that the more active part of the institute might be moved to a more central position near the main Government offices.

Part of the reason why the institute had been relatively ineffective he considered, was because it had been banished to South Kensington.

The South Kensington site was owned almost entirely by the Government, but there was no definite planning. One could conceive the existing institute building turned into a great Commonwealth scientific library, the untidy and somewhat purposeless buildings in the hinterland disappearing, and a great scheme of development, whereby a scientific college could be established worthy of the site.

Apathy of the general public on colonial questions was blamed by Lord Ogmore as the main cause of the failure of the institute. He said that if it was agreed that the Imperial College might take over the premises, then the institute must die. There was no other place in the metropolis suitable for it.

Lord Hailey asserted that in the past the institute had received somewhat cavalier treatment, but the recommendations in the report were on the whole sound. No change, he considered, should be made until the Government could find the institute new and suitable buildings and had made financial provision for its future. Until then the friends of the institute hoped that the Government would continue to honour the trust placed upon them.

Could Be More Useful

In the opinion of Viscount Hudson much could be done to make the exhibitions more useful and attractive without a great deal of expenditure. Until a more central building was available the institute should remain where it was.

In recent times the exhibitions had improved said the Earl of Lucan, and the present authorities had gone a long way towards achieving modern exhibition technique. In one respect they had not been successful; there was not enough about the people of the Commonwealth and colonies or about their problems.

Lord Sempill said that he supported the motion because of the need for greater facilities for scientific and technological education and for greater industrial production.

It was difficult not to be driven to the conclusion that the work of the institute, though admirable in many ways, fell short of the task set by the founders, said Lord Tweedsmuir.

It was clear to the committee that the institute was fighting a losing battle. The time would come when it must be asked whether there was any purpose in maintaining the institute in buildings so costly to

recondition and maintain, and whether the buildings should be put to some other use. London University had strong claims: Lord Falmouth had put forward the claims of the Imperial College of Science. In the end the committee came to the conclusion that the institute could serve a valuable purpose in the future.

The committee had felt the institute had a great part to play, but if it was not possible to carry out the drastic reorganisation suggested it was felt that it should be closed down. The idea had not received a very favourable reception, but it had been unanimously felt that the institute as constituted was not equal to its task and that its very existence belittled the importance of the work it was trying to do.

No Announcement Now

No definite pronouncement by the Government as to the future of the institute was desirable at present according to the Earl of Listowel. The Tweedsmuir report had only just been published and there had not been sufficient time for the Commonwealth Governments to give their views. It seemed only fair, too, that the new director should have a chance of beginning the changes which he would be responsible for carrying out. There could hardly be a more useful governmental action than the establishment of a Commonwealth centre on the lines suggested.

Earl De La Warr, Postmaster-General, said he was at present unable to say anything about the Government's future schemes for higher technological education or their considerations of Lord Tweedsmuir's report, but it was hoped that the Government would be able to make a definite statement of their views on these matters early next year. It was important that they should first have the full views of all other interested bodies, particularly the universities.

The Government were very far on with the consideration of this policy. Their lordships would not be far wrong if they guessed that it must have some effect on the future development of the Imperial College. It would be an understatement to say they were faced with the question of space for development. The problem was a complete jigsaw puzzle.

If the institute was to continue, it would have to do so as a much livelier instrument of Colonial and Dominion education than it had been. The institute was on its own site and it was the only definite and concrete imperial effort in London at the present time. It would require legislation to change its home. It was financed and supported by 49 Governments and it could not be wound up without discussion with them.

As soon as it was possible to discuss definite proposals, the Government, having control of so much of the land adjoining the college buildings at South Kensington, would be concerned to help the development of the Imperial College in the best way they could. How far that would involve the institute he could not say in advance. He could not say it would be removed to another site, but he could say it could not even be considered until the whole matter had been thoroughly discussed.

The motion was, by leave, withdrawn.

Zagreb International Fair

Potential Market for British Chemicals

YUGOSLAVIA's importance as a potential market for British exports was emphasised at the private showing in London on 9 December of a film of the Zagreb International Fair, 1952, at which for the first time in its history a pavilion was set aside to represent British industry, about 215 firms taking part.

In the value of goods sold Britain came fifth, the first four countries being Germany, France, Austria and Italy. According to the producers of the film, the Augur & Turner Group, Ltd., there is a strong inclination for Yugoslavia to prefer British goods, but a difficulty at present was the time required for delivery of orders. Shots of the film showed the official opening, the visit of Marshal Tito, and views of the British exhibits which were mainly devoted to the heavy industries—agricultural machinery, transport, automobiles, and electrical equipment. British chemicals were represented by Imperial Chemical Industries, Ltd.

The 1953 Zagreb Fair will be held from 13-27 September, when it is hoped British participation will be even better. Applications for space received so far would fill about half the pavilion. Asked if other chemical firms would be taking part, Mr. R. H. Empson, chairman of the Augur & Turner Group, Ltd., said it was not known at present, but there were excellent opportunities for chemicals and fertilisers.

The Chemist's Bookshelf

LABORATORY COURSE OF CHEMICAL ANALYSIS. By E. S. Davies and G. V. Jeffreys,. English Universities Press, Ltd., London. 1952. Pp. 96. 6s. 6d.

This booklet is one of the Technical College Series designed to prepare students for the various National Certificates issued by the Ministry of Education in collaboration with the leading professional institutions. This particular course is intended for the use of part-time students preparing for the National and Higher National Certificates in Chemistry (Pure and Applied). At the same time it contains the necessary basic information for those students preparing for the more academic courses in chemistry leading to a degree or an associateship of the Royal Institute of Chemistry. An abridged version of the course would be suitable for students preparing for the National Certificate in Metallurgy, and also for technological courses in which inorganic chemical analysis is to play a part. It should also be useful for apprentices and junior chemists in the laboratories of chemical and metallurgical firms.

The book itself contains two parts—one on volumetric and the other on qualitative analysis. One advantage it possesses is the use of normality factors. These are not always included in textbooks, but as they are inevitable in the laboratory, training in their use is salutary. In the volumetric section, experiments are clearly described demonstrating acid-base titrations, the use of permanganate, dichromate, iodine and silver nitrate. An advanced section includes the use of NaOH, ceric sulphate, potassium bromate, chloramine-T and other reagents, as well as the estimation of nickel, aluminium, iron and manganese.

Qualitative analysis is dealt with clearly, and an unambiguous scheme of analysis is set out. One good feature is the list of operations performed on the *filtrates* obtained after each group precipitate is filtered off. This gives the continuity of the analysis and enables the performer not only to put aside each group precipitate but to remember the sequence of operations more easily, an important feature for the beginner. Simplicity is aimed at, and no alternative methods are given. One criticism, however, is that many of the results of the tests are merely stated in terms of their appearance, and the nature of the precipitates and coloured compounds produced is not always, or even often, mentioned. This is a handicap to the memory, since the operations performed can become a rule-by-thumb routine to the lazy, if, indeed, it is possible to remember all the sequences of operations at all without understanding their purport. —J.C.S.

CHEMICAL ENGINEERING TECHNIQUES. By B. E. Lauer and R. F. Heckman, Reinhold Publishing Corporation, New York. Distributed by Chapman & Hall, London, 1952. Pp. 496 × iv. 48s.

This book is intended primarily for students of chemical engineering as an introduction to industrial techniques. To this end the authors have arranged the subject matter under seven sections dealing respectively with (I) Assembly of Materials, (II) Preparation of Material for Reaction, (III) Production and Distribution of Energy, (IV) Conditions affecting the Chemical Reaction, (V) The Separation and Purification of Materials, and (VI) Further Treatment of Products for Sale, Shipment, Storage, and other use. Each section is further subdivided into chapters, of which there are 25 in all, Section V being the largest and containing 8 chapters. The treatment is descriptive, the object being to introduce the student to the available techniques rather than to establish the fundamental concepts on which the techniques are based. Extensive use is made of illustrations, over 100 figures are included in the text and these are of modern equipment and extremely well chosen.

Unfortunately the subject matter is too voluminous to be treated adequately in a single volume of this size and in consequence

the text suffers by being too condensed. This is natural in a book which ranges from transportation by ocean-going tanker, through nuclear reactions to the refractive index measurement of products. Vacuum distillation is dealt with in a paragraph of seven lines and solvent extraction in less than a page. These are not isolated examples, almost every subject is dealt with in a similar manner and the book is in effect an extended catalogue of industrial techniques.

This book does, however, serve a very useful purpose in that it places the various techniques in perspective. The student is too apt to assume that chemical engineering is all distillation and absorption or heat transfer and fluid flow, and to neglect the many other techniques with which he will be faced in industry. As a basis for a lecture course the book is admirable but it does require that such a course should be implemented by detailed discussion of the more important unit operations.—F.M.

THE COMPOSITION AND ASSAYING OF MINERALS. By John Stewart-Remington and Wilfred Francis. The Technical Press, Kingston Hill, Surrey. 1952. Pp. 127. 17s. 6d.

In their preface, the authors state that this book 'relates primarily to the chemical composition of minerals, with the object of providing a handy guide to their qualitative and quantitative examination.' In the book, they treat indiscriminately 'material,' 'mineral' and 'ore.' They do not show how knowledge of chemical composition affords guidance to examination.

Part I is devoted to the identification of bases and acids by dry and wet methods. It would have been improved if it had been complete—why should the reader have to be referred to a book on blow-pipe analysis?

In Part II each metal is dealt with in turn. First a summary is given of the ore-minerals and their properties. The choice of minerals is somewhat arbitrary. The notation employed for their composition is most erratic (e.g., freieslebenite, polybasite). It is a pity that reference is made to place of occurrence; this can be of no value in a book of this sort.

Then follows a number of qualitative tests for a simple salt. There are so many uncorrected misprints in the chemical formulae that this section loses much of its value.

The closing section on each metal deals with quantitative assay. It is difficult to see the value of this section to anyone dealing with minerals or with ores. The authors give a colourless outline of chemical manipulation without any indication of what is happening. There is no indication of interfering elements or of short cuts if certain elements are absent. The strengths of solutions and their metallic equivalents are given in some cases and omitted in others. Insufficient emphasis is placed on difficulties. For instance, the two major difficulties in the assay of tin ores are the getting of a true sample and the complete dissolution of the tin mineral. After describing a quantitative assay of 'the mineral' the authors mention that a stannic ore may require reduction by hydrogen or fusion.

In Part III the title is 'Typical Analyses of Ores,' although this appears in the 'Contents' as 'Typical Assays of Ores.' Only one charge is given for gold ores, and no reference is given to the nature of the ore. Nowhere in the book is reference made to any gold mineral except native gold. In the description of the estimation of zinc in Burma zinc concentrates there is no mention of the minerals present; no reason is given why the process is different from that given earlier in the book.

Part IV is devoted to the non-metallic minerals. A summary of the minerals is followed by a scheme for their analysis.

The book closes with chemical and mathematical data and the scheme for general analysis. Coefficients of deci-normal solutions are given. A note is inserted that all solutions should be standardised under conditions similar to those of the assay, and that in most laboratories solutions are of such a strength that one milli-litre is equivalent to ten milli-grams. A list is given of chemical reactions during titrations.

It is difficult to see what the authors had in mind when planning the book. The scope of the book is too limited for the specialist, while the treatment is too general for the non-specialist. There is a feeling that much of the book is outside the actual experience of the authors, and that they have little appreciation of the real difficulties of the work they describe; there is little emphasis on the things that really matter. —J. K. GRAHAM.

PERSONAL

MR. NORMAN LUKE, since 1948 London Division Chemical Sales Manager, Shell Chemicals, Ltd., is shortly leaving to take up an important appointment overseas in connection with the sales of Shell's chemical products.

Prior to joining Shell Chemicals, Ltd., Mr. Luke took a chemistry degree at Oxford, after winning an Open Exhibition in Natural Science at Jesus College from the Royal Grammar School, Newcastle-upon-Tyne.

During the war Mr. Luke served in the Royal Corps of Signals with the Indian Army and PAI-Force in the Middle East and was demobilised in 1946 with the rank of major.

A keen sportsman, he played rugger for Combined Services MEF in 1945 and 1946, and has lately skippered the Lensbury Club First Hockey XI besides playing cricket for the club second team.

Mr. Gordon Philips

Mr. Norman Luke

MR. S. GORDON PHILIPS, who succeeds Mr. Luke, joined the Shell Group in 1939 and served his early days in Anglo-Saxon tankers as an apprentice. After the outbreak of war he joined the RNR as a midshipman and later transferred to the Royal Marines, rising to the rank of major. He saw service in the Middle East and Far East, was on the staff of Flag Officer (Air) East Indies, and subsequently G.2 (Air) 33 Corps. He is still an active member of the RMFVR and indulges in sailing as a hobby.

Returning to the Shell Group in 1946, Mr. Philips joined Shell Chemicals Ltd., and, in 1951, became assistant sales manager, London Division.

MR. G. E. STOCKWELL recently left the Industrial Chemical Home Sales Department of A. Boake, Roberts & Co., Ltd., Stratford, London, E.15, to take up a fresh appointment with Alwitt Trading Co., Ltd. As manager of the industrial chemicals division he will be concerned both with home and export sales of industrial chemicals and other raw materials. The company is situated at No. 1 Broad Street Place, London, E.C.2, and the telephone number is LONdon Wall 7966.

MR. G. H. CASH, an American, and managing director of the Cabot Carbon, Ltd., Stanlow, Ellesmere Port, sailed for a five weeks' visit to the United States in the liner *Queen Elizabeth*, on 8 December. He will negotiate certain business for his firm while away, and would also visit his son who is a cadet at the Military Institute at Texas.

The Ceylon Government's Ministry of Industries has appointed MR. J. F. BAGNALL, of Penley, near Wrexham, to supervise the designing of a plant for a vegetable oil extraction factory. The new factory will be one of a number which the Ministry propose to erect in the course of the next few years under the Colombo Plan. The appointment is for a term of three years in the first instance. Mr. Bagnall, who is 50, served his apprenticeship in the gas and oil engine plants of Messrs. Crossley Bros., Ltd., Openshaw, Manchester, and after experience with a number of other firms, became consulting engineer for Messrs. MacNeill & Company, Calcutta, in 1925. From 1950-52 Mr. Bagnall has been senior engineer of the Structural and Design Division of the Bahrein Petroleum Company. He left Britain for Ceylon on 4 December.

Aluminium Plant Project

A plant with a capacity of 10,000 tons of aluminium a year is proposed as part of the Government of India's Five Year Plan. Location of the factory is likely to be in the Sambalpur district of Orissa where the Hirkand hydroelectric project is being constructed, according to a reported statement of the Minister of Commerce and Industry.

HOME

U.K. Zinc Consumption

Despite an increase in the use of zinc to 15,600 tons in October, compared with 14,500 tons in the previous month, the total consumption of zinc in the United Kingdom for the 10 months ending 31 October, was the lowest for any post-war year. Consumers' stocks fell sharply after the resumption of zinc trading on the Metal Exchange, but Government-held stocks are high.

Scheme Approved

A scheme prepared by the Steel Company of Wales, Ltd. for the further modernisation of the South Wales tinplate industry, estimated to cost £40,000,000, has been approved by the Iron and Steel Corporation.

Pollution of the Derwent

The appeal of the Derby Corporation against an injunction granted by Mr. Justice Harriman on 7 and 9 April, 1952, restraining it from polluting the river Derwent by the discharge of effluent from its sewage works was dismissed by the Court of Appeal on 15 December. The Master of the Rolls, presiding, said that the corporation had caused a private nuisance and was liable to be sued in the Courts like any other subject. Terms of a similar injunction against the British Electricity Authority were varied by the Court so as only to prevent it from returning water to the river from its cooling towers in such condition as to cause injury to fish.

Society for Visiting Scientists

Professor S. Sambursky, director of the Research Council of Israel, gave a talk on 'Science in Israel,' at a meeting of the Society for Visiting Scientists which was held at 5 Old Burlington Street, London, W.1, on 18 December. Dr. Alexander King was in the chair.

Key Industry Duty

The Treasury have made an Order under Section 10(5) of the Finance Act, 1926, exempting from Key Industry Duty for the period 15 December, 1952, to 18 February, 1953, *p*-(di-*n*-propylsulphamyl) benzoic acid and quinoline.

Franco-British Congress

The Third Franco-British Pharmaceutical Congress will be held in Harrogate from 15-18 May, 1953, when papers will be read by members of the Ordre National des Pharmaciens de France and the Pharmaceutical Society of Great Britain.

Refinery Fire at Renfrew

Hundreds of tons of oil in tanks and drums were lost in a fierce outbreak of fire which destroyed the oil refinery of J. O. Buchanan & Co. Ltd., Renfrew, on 8 December. A loud explosion was the first indication of the fire. More than 70 firemen, including the Glasgow fire float, and units from Renfrew, Paisley, Barrhead, and Johnstone were quickly on the scene. Foam extinguishers were used at first, but later the firemen resorted to water. Water was pumped from the River Clyde because the normal supply from the mains proved insufficient. Three hours after the outbreak started the fire was under control. The main building of the refinery was gutted, and damage was estimated at many thousands of pounds.

Cathodic Protection Safeguard

Increasing use of cathodic protection to safeguard pipelines, tank bottoms, bottoms of tankers, water tanks, jetties, bridge foundations and many similar structures was noted by K. A. Spencer, speaking to the Institute of Petroleum in Glasgow recently. The speaker, who outlined the electrochemical background of the method, declared that when properly installed and maintained, cathodic protection could give an infinitely longer life to such structures.

Christmas Lecture for Children

'Colours and How We See Them,' will be the subject of a Christmas lecture for children (12 to 18 years of age) to be given by Dr. T. Vickerstaff (Dyestuffs Division, Imperial Chemical Industries, Ltd.), in the chemistry lecture theatre, University of Manchester, at 3 p.m. on Tuesday, 30 December. The talk organised by the Manchester Federation of Scientific Societies, will be repeated on the following day at the same time and place.

LEWIS BERGER & SONS LTD. — BECK, KOLLER & CO. (ENGLAND) LTD.

JOINT ANNOUNCEMENT

Lewis Berger & Sons Ltd., Styrene Co-Polymers Ltd. (their Licencees), and Beck, Koller & Co. (England) Ltd., jointly announce agreement relating to their respective patents covering the field of styrene co-polymers.

Each Company recognises the validity of each other's patents in this field. The existing patent specifications are as follows:—

BERGER:

573,809	609,750	630,022
573,835	611,109	634,570
580,912	615,802	640,832
580,913	616,044	640,836
605,929	622,948	649,443
609,749	622,949	654,031
		675,761

BECK, KOLLER:

638,835	651,560	651,561

Royalty payments by the Companies are a provision of this Agreement and for example will accrue in respect of the Beck, Koller product STYRESOL 9255, which, like Styrene Co-Polymers' product SCOPOL 71X, is manufactured under Berger patents.

The parties announce that they are prepared to protect their interests in this field against infringement of their patents for the manufacture and use of styrene co-polymer products.

OVERSEAS

Indian Rare Earths

A factory for processing monazite will be officially opened by the Indian Prime Minister at Alwaye on 24 December. The new works which have been undergoing trial runs for the past two months processing monazite sands and extracting thoria and rare earth chemicals, is run by Indian Rare Earths Ltd., a joint venture of the Indian and Travancore-Cochin Governments.

Titanium Plant to Reopen

The titanium plant at Trivandrum, the capital of Travancore-Cochin State in India, will be shortly reopened, it is reported. The factory, which opened only a year ago, was closed recently. The State Government, which invested about 4,000,000 rupees in the unit, is now considering the question of reviving the project by means of a loan from the Industrial Finance Corporation. At the same time, the Indian Government has agreed to supply technical advice.

Natural Neptunium Found

Bearing out Dr. Seaborg, of the University of California, when he predicted in 1947 that neptunium 237 and plutonium would eventually be found in nature, is the recent discovery of the first-named in ore from the Belgian Congo, first reported to the 122nd meeting of the American Chemical Society. Only 3×10^{-10} oz. of it have been isolated, and it will be easier to obtain the element for experimental purposes from uranium piles or cyclotron bombardment. Neptunium, first trans-uranium element to be discovered, in 1940 (isotope 239) has its 237 isotope as the long-lived parent of the Neptunium series ($4n + 1$), with a half-life of 2.2×10^6 years. It decays into Pa 233 by loss of an alpha-particle.

Ultrasonics as a Steriliser

It has been found in America that ultrasonic vibrations of about 1,000,000 vibrations per second are effective for sterilising water and milk supplies. At this frequency, a beam of sound begins to acquire the properties of a beam of light, and it can be focused by a lens. The vibrations are produced by quartz crystal, and quantitative experiments are in progress to define the limitations and conditions which must be observed under commercial conditions.

Streptomycin in Sweden

Europe's first streptomycin factory was opened in Sweden at Strängnäs, near Stockholm, on 8 December. The ceremony was performed by Prince Bertil, who was accompanied by Professor Selman Waksman, of Rutgers University, New Jersey, U.S.A. Production will not begin until the New Year, but the Kabi company, which manufactures penicillin and other antibiotics, took advantage of the visit to Sweden by Professor Waksman to receive his Nobel Prize for the discovery of streptomycin, to arrange the opening.

Too Many Noughts

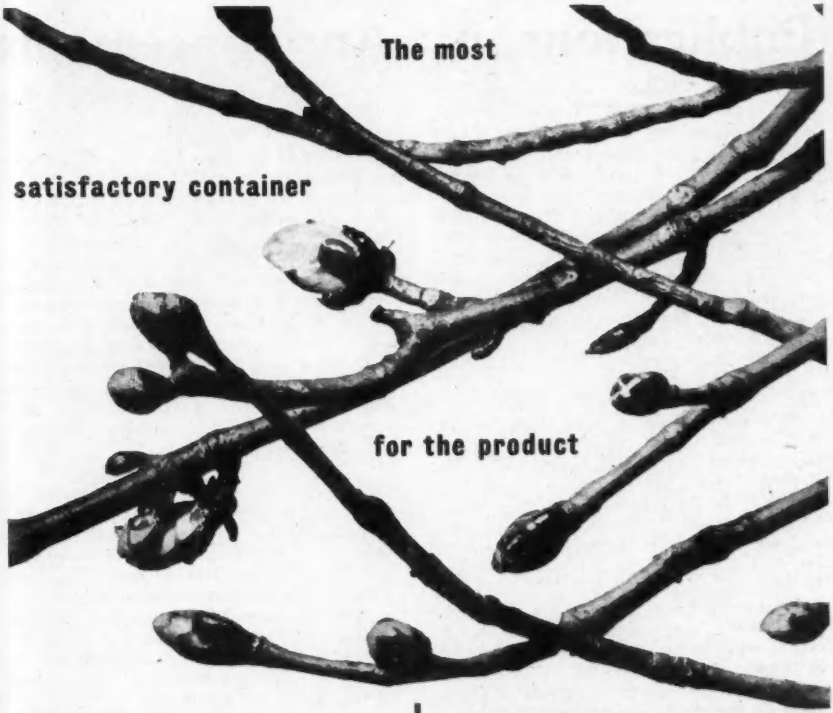
In the Indian News Letter appearing on Page 597 of our issue of 1 November it was stated that India expected to export 7,500,000 tons of salt to Japan before the end of the current year, and that about 4,000,000 tons had already been shipped. Dr. M. S. Patel, the Bombay consulting chemist and chemical engineer, informs us that this was a misprint and should have read 750,000 tons and 400,000 tons. As Dr. Patel points out, the total production of India will not amount to more than 3,500,000 tons for some time. Her present consumption is approximately 2,700,000 tons.

Sulphuric Acid Plant at Port Pirie

A sulphuric acid plant now nearing completion for the Electrolytic Zinc Company, at Port Pirie, Australia, will utilise all the lead smelter gases which formerly went to waste. The plant, which was designed and constructed in England, is expected to be commissioned early in 1954. In order to ensure a higher sulphur dioxide content it has been necessary to make modifications to the Dwight Lord machines by employing a vanadium catalyst. Estimated yield of sulphuric acid is 45,000 tons a year.

Uranium Salts Produced in Adelaide

Production of uranium salts required by Britain and the U.S.A. for their atomic energy programmes has been in operation since October at a refinery plant in Adelaide. This was revealed on 15 December, following an inspection of the Radium Hill Mine by the Premier, Mr. Playford and the Defence Minister, Mr. McBride.



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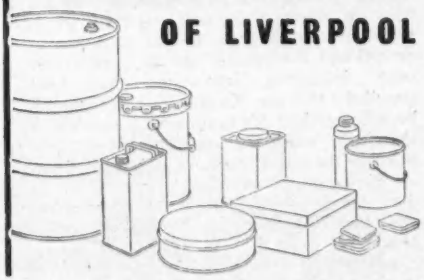

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Publications & Announcements

AN EXPLANATION of what centrifugal force is, and how centrifugal bowls function, is given in a new bulletin (No. 452) just issued by Sharples Centrifuges, Ltd., Woodchester, Stroud, Gloucestershire. Examples are given of clarification, separation, dam adjustment, and changing from separator to clarifier, but the description is confined to the working principles of the Sharples supercentrifuge, and no attempt is made to give structural details or operating instructions. The bulletin provides a useful basis of knowledge for the application of centrifuges to a wide variety of industries.

* * *

ZINC prospects for the next quarter of a century are summed up in an article in *Zinc Bulletin No.* 10 now available from the Zinc Development Association, Oxford. The summary, based on the Paley Report presented to the President of the U.S.A. by his Materials Policy Commission, shows that zinc supplies will be adequate to meet the expected growth in demand during the next 25 years with little or no growth in real costs. This issue of the *Bulletin*, which underlines the facts (not always fully appreciated), that zinc is now unrestricted in use and plentiful in supply, also contains articles on the use made at Margam of hot dip galvanised corrugated sheeting in the construction of Britain's biggest steel mill, and a scientific study on the use of zinc oxide in glazes by an internationally known ceramic expert.

* * *

DIETHYL tin, prepared by the German scientist Löwig in 1852, was the first of the class of compounds now referred to as organo-tin compounds, and as such was of exceptional theoretical interest. In recent years increasing importance has been attached to the organo-tin compounds because of their application in a number of chemical industries, the most important being in the manufacture of polyvinyl chloride plastic for moulding. An assessment of the value of Löwig's discovery is given in *Tin and Its Uses* (No. 27, November, 1952), obtainable from the Tin Research Institute, Greenford, Middlesex. Other articles cover the bi-centenary of Nicolas Appert, founder of the canning industry (THE CHEMICAL AGE, 67, 655), and the surface conductivity of glass.

A METHOD of handling materials in bulk which is now being used extensively in the chemical and allied industries and which ensures that the least space is occupied in relation to the quantity conveyed or elevated is the '*en masse*' system described by Conveyors (Ready Built), Ltd., of Stroud, Gloucestershire, in its latest illustrated brochure. By the R.B. '*en masse*' system, bulk materials are induced to flow like a liquid, and thus, whether they are being conveyed horizontally, on an incline, or vertically, they travel smoothly and quiescently from inlet to discharge, without perceptible movement between the particles comprising the load. Four illustrations show R.B. elevators in action at chemical (pharmaceutical) and cosmetic works.

* * *

'POWER from Chemicals' is the subject of the latest technical newsletter *Background* (No. 3), published by the Central Publicity Department of Imperial Chemical Industries, Ltd. The development of explosives from the early uses of gunpowder, mainly in war, to the application of detonating methods in industry is traced and technical notes are given on the constitution, reaction and so on, of 11 different materials from which power can be generated.

* * *

SINCE oils were first suggested as alternatives to mercury as pumping fluids for diffusion pumps, a large number of organic and semi-organic materials have been applied to this use. All these have differing characteristics which may affect the choice of fluid for a particular application, while the use of mercury itself is still essential in some cases and desirable or at least defensible in others. In an article 'An Assessment of Some Working Fluids for Diffusion Pumps' (*Vacuum*, Vol. II, No. 1, January, 1952), D. Latham, B. D. Power and N. T. M. Dennis, of W. E. Edwards & Co. (London), Ltd, Research Laboratories, describe some of their own experiences and discuss how some of the characteristics of a selection of pumping fluids would influence a user in his choice. The successful application of vacuum techniques to metallurgy, particularly the production of magnesium, calcium, tantalum and zirconium, are described in an article by Dr. G. L. Miller, of Murex, Ltd.

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Public Analysts' Meeting

Papers Read on Forensic Science

THE eighth annual general meeting of the Physical Methods Group of the Society of Public Analysts and Other Analytical Chemists was held on 25 November, 1952, in Burlington House, Piccadilly. Dr. J. Haslam occupied the chair and there were 41 other members present.

The following papers on 'Forensic Science' were presented and discussed at the ordinary meeting which followed:—

'The Application of Some Physical Methods in Forensic Science with Particular Reference to the Examination of Materials Relating to Criminal Investigation,' by J. B. Firth, D.Sc., F.R.I.C., M.I.Chem.E.

Forensic Science

The investigator, said Dr. Firth, is continually meeting problems of identification of miscellaneous specimens. Among these are fragments of glass and precious stones for which density, hardness and refractive index all play an important part. Certain solids are recognised by melting-point, and liquids, e.g., mixed petroleum products, by fractional distillation or boiling-point determination. Ultra-violet fluorescence is employed for the examination of stones, while spectrographic analysis is an invaluable tool for the identification of minute specimens of paint, glass, etc. Carbon monoxide can be estimated by spectral absorption in the visible region, and certain alkaloids by their ultra-violet absorption. Other methods involve colorimetry or nephelometry or chromatographic examination. In most cases several methods may be applied to one microscopic specimen to gain as much information as possible.

'The Examination of Questioned Documents,' by J. A. C. McClelland, D.Sc., Ph.D., A.R.I.C.

Examination is carried out, said Dr. McClelland, of documents which may have been mishandled in any way such as to convey an impression different from that originally intended. This involves such processes as the reproduction of erased writing, the detection and presentation of added or altered particulars or of markings which have been faintly imprinted on documents. Other articles which may bear obliterated or altered impressions may also require examination.

The presence of materials foreign to the article under examination may also give valuable information as to the nature of any mistreatment which may have taken place.

The methods employed for this work involve the use of various types of illumination which are obtained by means of light filters or special types of lamps. Thus, for working in the infra-red region, a suitable filter and photographic plate is used, while the appropriate colour filter is needed for the reproduction of marks on a coloured object. For working in the ultra-violet region, a suitable lamp is employed.

The examination of typescript will usually reveal characteristics which should enable the identification of a certain machine; when this is possible any documents typed on one specific instrument can usually be considered to emanate from the same source.

Any evidence which may be obtained as a result of these investigations is reproduced in a manner suitable for presentation as evidence in a court of law.

Market Reports

LONDON.—There have been no outstanding price movements on the industrial chemicals market during the past week and quotations are steady at recent levels. Fresh business during the week has been on a moderate scale while inquiries for shipment have continued at a steady rate despite keen competition. With the approach of the end of the year buyers are showing a greater interest in contract replacements.

Rather better conditions have been reported from the coal tar products market and the outlook is showing signs of improvement.

MANCHESTER.—From the point of view of new bookings only moderately active trading conditions have been experienced on the Manchester market for heavy chemical products during the past week. Partly this is due to the approach of year-end stock-taking operations and partly to a cautious policy which has developed among buyers during recent months. However, on the whole fair quantities of alkalis and other leading lines are being taken up against orders already placed. This applies both to the home trade and to exports. Moderately active conditions are reported in the fertiliser market and in respect of the leading tar products.

Indian Tariffs

Reviewing the first eight months' work of the Indian Tariff Commission, *Indian Trade and Industry* points out (4,15,342) that the following industries are amongst those now enjoying tariff protection:—alloy tool and special steels; aluminium; antimony; artificial silk yarn, etc.; bichromates; calcium lactate coated abrasives; ferro-silicon; glucose; hydroquinone; non-ferrous metals; sodium sulphite, bisulphite, and thiosulphite; phenol formaldehyde moulding powders; soda ash and stearic and oleic acids.

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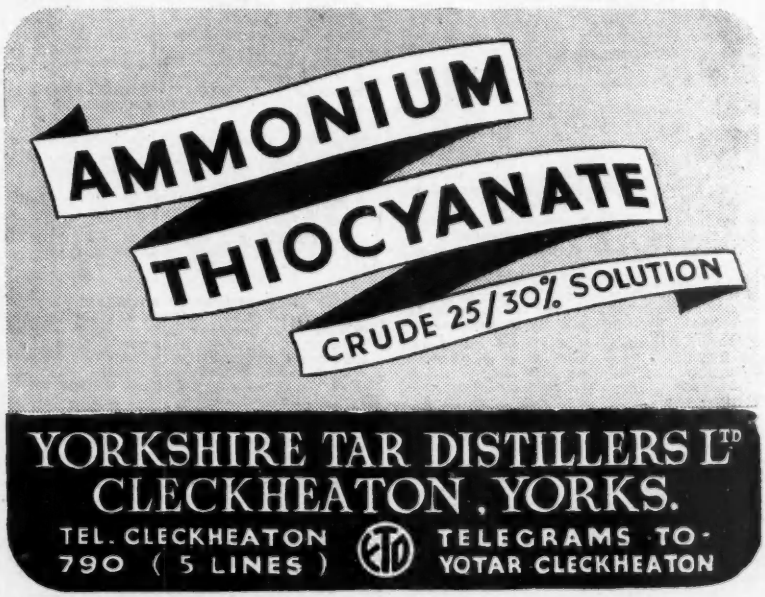

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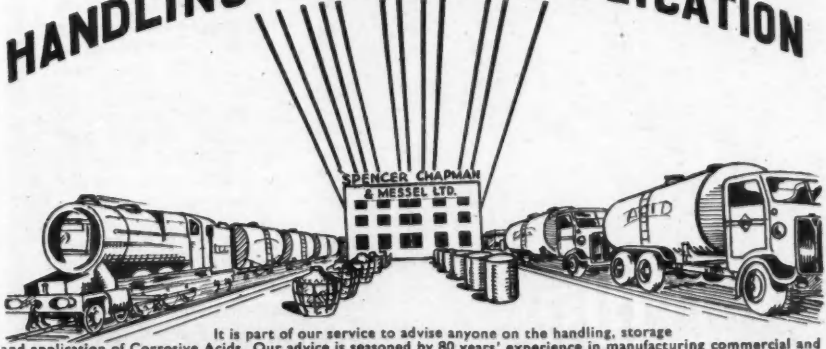

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